NTPC- NORTH KARANPURA
(3 x 660 MW)

TECHNICAL SPECIFICATION
FOR

CONTROL VALVES WITH ACCESSORIES

(Pneumatically Operated)

(FDV-14)

SPECIFICATION No: PE-TS-405-145-I 104

BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT DIVISION
NOIDA, INDIA

1.0 The tender document contains three (3) volumes. The bidder shall meet the requirements of all the three volumes.

1.1 **Volume-I (CONDITIONS OF CONTRACT)**

This consists of four parts as below :-

Volume-IA	:	This part contains instructions to bidders for making bids to BHEL.
Volume-IB	:	This part contains general commercial conditions of the tender & includes provision that vendor is responsible for the quality of item supplied by their sub-vendors.
Volume-IC	:	This part contains special conditions of contract.
Volume-ID	:	This part contains commercial conditions for erection & commissioning site work, as applicable.

1.2 **Volume-II TECHNICAL SPECIFICATIONS**

Technical requirements are stipulated in Volume-II which comprises of :-

Volume-IIA	:	General Technical Conditions
Volume-IIB	:	Technical Specification including Drawings, if any.

1.2.1 **Volume-IIB**

This volume is sub-divided into following sections :-

Section-A	:	This section outlines the scope of enquiry.
Section-B	:	This section provides "Project Information".
Section-C	:	This section indicates technical requirements specific to the contract, not covered in Section-D.
Section-D	:	This section comprises of technical specifications of equipments complete with data sheet A, B and C.

Data Sheet - A specifies data and other requirements pertaining to the Equipment.

Data Sheet - B Specifies data to be filled by the bidder (Data Sheet-B is contained in Volume-III).

Data Sheet - C Indicates data/documents to be furnished after the award of contract as per agreed schedule by the vendor (as applicable).

1.2.2 **Volume-III TECHNICAL SCHEDULES**

This volume contains technical schedules and Data Sheets-B, which are to be duly filled by the bidder and the same shall be furnished with the technical bid as per instructions given in Document No. PE-SS-999-100-Q-002 in Volume-III.

2.0 The requirements mentioned in Section-C / Data Sheets-A of section-D shall prevail and govern in case of conflict between the same and the corresponding requirements mentioned in the descriptive portion in Section-D.

CONTENTS

VOL-II B

SECTION – A

SCOPE OF ENQUIRY

SCOPE OF ENQUIRY

1. SCOPE

1.1 This specification covers the Design, Manufacture, Inspection and Testing at manufacturer's works, proper packing for transportation and delivery to site of the **Control Valves with Pneumatic Actuator along with Accessories, Start-up/Commissioning and Mandatory Spares** as mentioned in different sections of this specification for 3X660MW NORTH KARANPURA

1.2 The quality plan enclosed forms the minimum requirement but not limited to be adhered to by the bidder. Bidder to sign and stamp the same and submit along with the offer as an acceptance.

1.3 Bidder to note that CV test is required to be conducted as per Quality Plan (Section-D). Bidder to group such valves and indicates the same along with the price bid. Unpriced portion to be submitted to engineering.

1.4 Following signed & stamped documents with company seal to be submitted by bidder.

a) Complete offer including calculation sheets, catalogues etc.
b) Quality Plan
c) Datasheet A & B, duly filled
d) Schedule of prices & unit prices, inspection schedule
e) Schedule of submission of drawings/documents, equipment manufacture, inspection & dispatch.

2 GENERAL TECHNICAL INSTRUCTIONS

2.1 It is not the intent here to specify all the details of design and manufacture. However, the equipment shall conform in all respects to high standard of design, engineering and workmanship and shall be capable of performing the required duties in a manner acceptable to the customer / consultant, who will interpret the meaning of drawing and specification and shall be entitled to reject any component or material which in his judgment is not in full accordance herewith.

2.2 The omission of specific reference to any component / accessory necessary for the proper performance of the equipment's shall not relieve the supplier of the responsibility of providing such facilities to complete the supply within the quoted prices.

2.3 BHEL' s / Customer' s authorized representatives shall be given access to the shop in which the equipments are being manufactured or tested and all test records shall be made available to them.

2.4 The Equipment covered under this specification shall not be dispatched unless the same have been finally inspected, accepted and Material Dispatch Clearance Certificate (MDCC) is issued by BHEL / Customer.

SECTION – B

PROJECT INFORMATION

1.00.00 **BACKGROUND**

North Karanpura Super Thermal Power Project (3x660 MW), a pit head coal based thermal power project, is located in Hazaribagh and Chatra districts of Jharkhand State. Basic inputs i.e. coal, water and land have already been tied up. The project is proposed for the States & Union Territories of Northern, Western and Eastern Regions and the State of Jharkhand.

The capacity of the project is 1980 MW comprising of three (3) units of 660 MW each.

1.01.00 **Location and Approach**

The power project is proposed to be located near Tandwa town in Chatra districts in the state of Jharkhand on Hazaribagh-Chatra State highway at a distance of about 50 kms from Hazaribagh city. The nearest commercial airport is Ranchi at a distance of 150 kms from project site. The nearest railhead Khalari Railway Station on Ranchi-Garhwa section of Eastern Railways is about 40 kms from project site.
Major rail/road distances from the project site are as under:

City		**Distance Approx. (kms)**
Ranchi	:	150
Khalari	:	40

The site is located near Tandwa town having latitude and longitude of about 23^0 50' N to 23º 52' N and 84^0 59' E to 85º 2' E respectively. The Vicinity Plan of the project is placed at **Annexure-I.**

Further to the information given in this sub-section, Bidders are also advised to visit the project site and collect data on local site conditions.

1.02.00 **Land**

About 2245 acres of land is being acquired for the project. About 1500 acres of land is under possession/legal possession and out of 1500 acres, about 890 acres of land is to be used for plant, ash dyke and initial enabling township. No additional land is envisaged to be acquired in plant area. About 15 acres of land is envisaged to be acquired in Hazaribagh city for Township.
Commissioner, Chatra vide dated 25.05.1999 and 14.06.2000 has given in-principle clearance for NKSTPP.

1.03.00 **Water**

Make up water available for this project would be about 22 cusec and will be arranged by constructing a dam/reservoir across river Garhi.

1.04.00 **Fuel (Coal)**

1.04.01 **Coal Requirement, Availability and Linkage**

Coal requirement for the project is estimated as 10.6 Million Tonne/Annum (MTPA), considering a GCV of 3800 kcal/kg. Ministry of Coal vide letter dated 21.10.99 accorded in-principle coal linkage of 10.00 MTPA subject to ratification by Standing Linkage Committee-Long Term (SLC (LT)), of MOC. SLC (LT) in its meeting held on 15.12.2000 firmed up the coal linkage of 10.24 MTPA for the project. Subsequently, the coal linkage was withdrawn by SLC (LT) in its meeting held on 22/23.10.08.

Cabinet Committee on Investment (GOI) in its meeting on 20.02.13 decided in-principle to restore the original coal linkage granted to NKSTPP (i.e. from Magadh Coal Block) with the stipulation that the coal supply will commence during the 13th Five Year Plan. MOC vide letter dated 09.05.2013 restored the coal linkage with the stipulation that the coal supply will commence during the 13th five year plan.

1.04.02 **Coal Transportation**

Coal from Magadh block of North Karanpura Coalfields is proposed to be transported to the project site through conveyor belt system. One external coal handling plant and one internal coal handling plant are envisaged.

1.05.00 **Meteorological Data**

Important meteorological data from nearest observatory at Hazaribag is placed at Annexure-II**.**

1.06.00 **Plant Water Scheme**

The Plant water scheme is described below.

1.06.01 **Condenser Cooling System**

It is proposed to adopt Air Cooled Condenser for the project.

1.06.02 **Equipment Cooling Water (ECW) System (Unit Auxiliaries)**

All plant auxiliaries shall be cooled by De-mineralized water (DM) in a closed circuit. The primary circuit DM water shall be cooled through heat exchangers by auxiliary cooling water system. The hot secondary circuit cooling water shall be cooled in the cooling towers and shall be returned back to the system.

1.06.03 **Ash Water System**

It is proposed to have HCSD (High concentration Slurry Disposal) system for combined fly ash and bottom ash. No recirculation of ash water from ash disposal area is envisaged.

1.06.04 **Other Miscellaneous Water Systems**

(a) Raw water shall be used for meeting the Fly ash and bottom ash system requirement etc.

(b) The service water shall be taken from clarified water tank of Pretreatment plant. Service water (wash water) collected from various areas shall be treated using oil water separators, tube settlers, coal settling pits etc. as per requirement and treated water from liquid effluent treatment plant shall be recycled back to the service water system for re-use.

(c) The drinking water requirement of the plant shall be provided from water treatment plant.

(d) Steam Cycle make-up water, makeup to the primary circuit of ECW (unit auxiliaries) system, boiler fill water and makeup to the hydrogen generation plant shall be provided from Demineralising plant.

(e) The quality of Raw water is enclosed with this sub-section as Annexure-III.

1.07.00 **Criteria for Earthquake Resistant Design of Structures and Equipment**

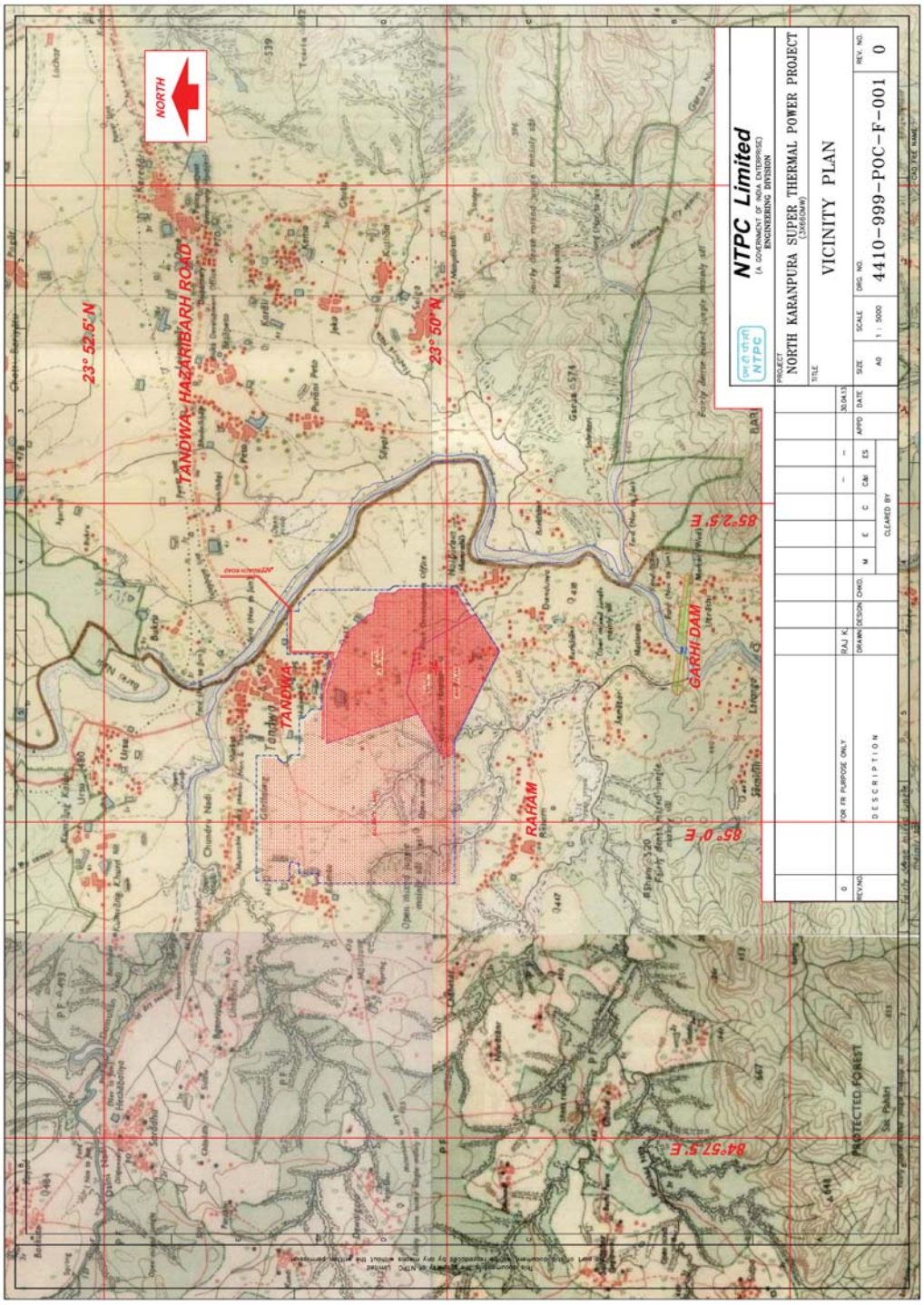
All power plant structures and equipment, including plant auxiliary structures and equipment shall be designed for seismic forces as given in the Part - B of this section.

1.08.00 **Criteria for Wind Resistant Design of Structures and Equipment**

All structures and equipment of the power plant, including plant auxiliary structures and equipment, shall be designed for wind forces as given as given in Part B of this section.

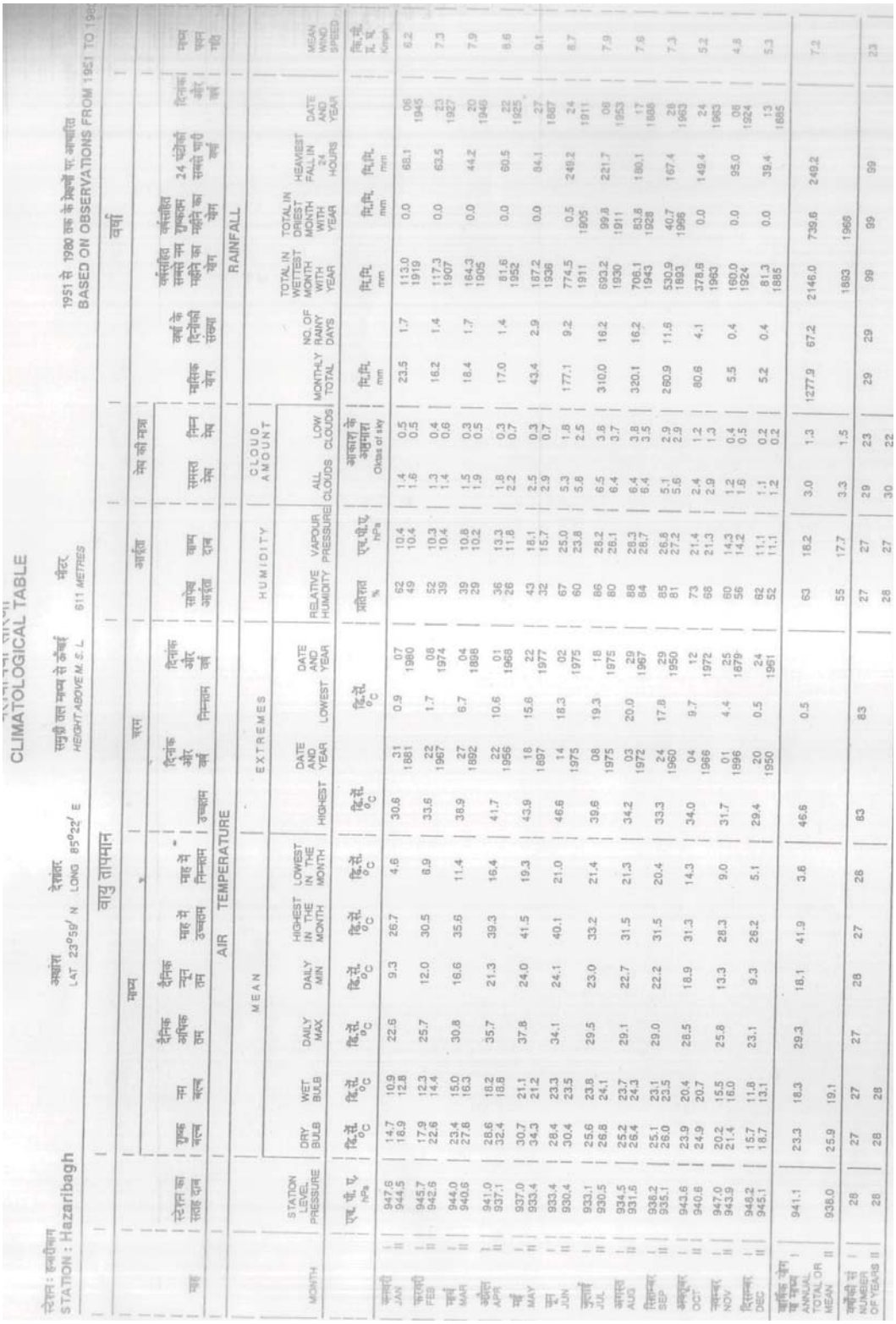
Annexure-I

VICINITY PLAN



Annexure-II

CLIMATOLOGICAL TABLE



CLIMATOLOGICAL TABLE

स्टेशन : हजारीबाग STATION : Hazaribagh

अक्षांश LAT 23°59′ N देशांतर LONG 85°22′ E समुद्री तल मापन से ऊँचाई HEIGHT ABOVE M. S. L. 611 METRES

1951 से 1980 तक के प्रेक्षणों पर आधारित BASED ON OBSERVATIONS FROM 1951 TO 1980

MONTH	STATION LEVEL PRESSURE hPa	AIR TEMPERATURE MEAN DRY BULB °C	MEAN WET BULB °C	MEAN DAILY MAX °C	MEAN DAILY MIN °C	EXTREMES HIGHEST IN THE MONTH °C	EXTREMES HIGHEST DATE AND YEAR	EXTREMES HIGHEST °C	EXTREMES LOWEST IN THE MONTH °C	EXTREMES LOWEST DATE AND YEAR	EXTREMES LOWEST °C	HUMIDITY RELATIVE HUMIDITY %	HUMIDITY VAPOUR PRESSURE hPa	CLOUD AMOUNT ALL CLOUDS Oktas of sky	CLOUD AMOUNT LOW CLOUDS Oktas of sky	RAINFALL MONTHLY TOTAL मि.मि. mm	RAINFALL NO. OF RAINY DAYS	RAINFALL TOTAL IN WETTEST MONTH WITH YEAR मि.मि. mm	RAINFALL TOTAL IN DRIEST MONTH WITH YEAR मि.मि. mm	RAINFALL HEAVIEST FALL IN 24 HOURS मि.मि. mm	RAINFALL DATE AND YEAR	MEAN WIND SPEED कि.मी. प्र. घं. Kmph
जनवरी JAN	I 947.6	14.7	10.9	22.6	9.3	26.7	31 1881	30.6	4.6	31 1881	0.9	82	10.4	1.4	0.5	23.5	1.7	113.0 1919	0.0	68.1	06 1945	6.2
	II 944.5	18.9	12.8									49	10.4	1.6	0.5							
फरवरी FEB	I 945.7	17.9	12.3	25.7	12.0	30.5	22 1967	33.6	8.9	06 1974	1.7	52	10.3	1.3	0.4	16.2	1.4	117.3 1907	0.0	63.5	23 1927	7.3
	II 942.6	22.6	14.4									39	10.4	1.4	0.6							
मार्च MAR	I 944.0	23.4	15.0	30.8	16.6	35.6	27 1892	38.9	11.4	04 1896	6.7	39	10.8	1.5	0.3	18.4	1.7	164.3 1905	0.0	44.2	20 1946	7.9
	II 940.6	27.6	16.3									29	10.2	1.9	0.5							
अप्रैल APR	I 941.9	28.6	18.2	35.7	21.3	39.3	22 1956	41.7	16.4	01 1968	10.6	36	13.3	1.8	0.3	17.0	1.4	81.6 1952	0.0	60.5	22 1925	8.6
	II 937.1	32.4	18.8									26	11.8	2.2	0.7							
मई MAY	I 937.0	30.7	21.1	37.8	24.0	41.5	18 1897	43.9	19.3	22 1977	15.6	43	18.1	2.5	0.3	43.4	2.9	187.2 1936	0.0	84.1	27 1887	9.1
	II 933.4	34.3	21.2									32	15.7	2.9	0.7							
जून JUN	I 933.4	28.4	23.3	34.1	24.1	40.1	14 1975	46.6	21.0	02 1975	18.3	67	25.0	5.3	1.8	177.1	9.2	774.5 1911	0.5 1905	249.2	24 1911	8.7
	II 930.4	30.4	23.5									60	23.8	5.8	2.5							
जुलाई JUL	I 933.1	25.6	23.8	29.5	23.0	33.2	08 1975	39.6	21.4	18 1975	19.3	86	28.2	6.5	3.8	310.0	16.2	693.2 1930	99.8 1911	221.7	06 1953	7.9
	II 930.5	26.8	24.1									80	28.1	6.4	3.7							
अगस्त AUG	I 934.5	25.2	23.7	29.1	22.7	31.5	03 1972	34.2	21.3	29 1967	20.0	88	28.3	6.4	3.8	320.1	16.2	706.1 1943	83.8 1928	180.1	17 1986	7.6
	II 931.6	26.4	24.3									84	28.7	6.4	3.5							
सितम्बर SEP	I 936.2	25.1	23.1	29.0	22.2	31.5	24 1960	33.3	20.4	29 1950	17.8	85	26.8	5.1	2.9	260.9	11.8	530.9 1893	40.7 1998	167.4	28 1963	7.3
	II 935.1	26.0	23.5									81	27.2	5.6	2.9							
अक्टूबर OCT	I 943.6	23.9	20.4	28.5	18.9	31.3	04 1986	34.0	14.3	12 1972	9.7	73	21.4	2.4	1.2	80.8	4.1	378.8 1963	0.0	149.4	24 1963	5.2
	II 940.8	24.9	20.7									68	21.3	2.9	1.3							
नवम्बर NOV	I 947.0	20.2	15.5	25.8	13.3	28.3	01 1896	31.7	9.0	25 1879	4.4	60	14.3	1.2	0.4	5.5	0.4	160.0 1924	0.0	95.0	06 1924	4.8
	II 943.9	21.4	16.0									56	14.2	1.6	0.5							
दिसम्बर DEC	I 948.2	15.7	11.8	23.1	9.3	26.2	20 1950	29.4	5.1	24 1961	0.5	62	11.1	1.1	0.2	5.2	0.4	81.3 1885	0.0	39.4	13 1885	5.3
	II 945.1	18.7	13.1									52	11.1	1.2	0.2							
वार्षिक योग वर्ष माध्य ANNUAL TOTAL OR MEAN	I 941.1	23.3	18.3	29.3	18.1	41.9	3.6	46.6			0.5	63	18.2	3.0	1.3	1277.9	67.2	2146.0 1893	739.6 1968	249.2		7.2
	II 938.0	25.9	19.1									55	17.7	3.3	1.5							
वर्षों की संख्या NUMBER OF YEARS	I 28	27	27	27	28	27	28	83			83	27	27	29	23	29	29	99	99	99		23
	II 28	28	28									28	27	30	22							

Annexure-III

RAW WATER ANALYSIS

Sl. No.	Constituent	as	mg per litre
1.	Calcium	CaCO3	65
2.	Magnesium	CaCO3	41
3.	Sodium	CaCO3	98
4.	Potassium	CaCO3	5
5.	Total Cations	CaCO3	209
6.	Total Alkalinity	CaCO3	150
7.	Chloride	CaCO3	25
8.	Sulphate	CaCO3	34
9.	Total Anions	CaCO3	209
9.	Silica (Reactive)	SiO2	9
11.	Iron	Fe	1.2
12.	pH Value	-	7.6-8.2
13.	Turbidity	NTU	200
14.	Organics(As per KMnO4 method)	Number	2

ANNEXURE-IV-1

TABLE-1

LIGHT DIESEL OIL CHARACTERISTICS
(AS PER IS 15770-2008)

	Characteristics	LDO
1.	Pour Point (max)	21 ℃ & 12℃ for Summer and Winter respectively
2.	Kinematic viscosity in centistokes at 40 deg.C	2.5 to 15.0
3.	Sediment percent by mass (max)	0.10
4.	Total sulphur percent by mass (max)	1.5
5.	Ash percentage by mass (max)	0.02
6.	Carbon residue (Rams bottom) percent by pass (max.)	1.50
7.	Acidity inorganic	Nil
8.	Flash point (Min.) - Pensky Martens	66 deg.C
9.	Copper strip corrosion for 3 hours at 100℃	Not worse than No. 2
10.	Water content, % by volume (max)	0.25
11.	GCV(kcal/kg)	10,000

TABLE-2 **ANNEXURE-IV-2**

HIGH SPEED DIESEL OIL CHARACTERISTICS

[AS PER IS **1460-2005 (BS-II)**]

S. No.	Particulars	Unit	Value
1.	PHYSICAL PROPERTIES		
	a. Distillation volume recovery @ 350^0C	% vol. (min)	85
	b. Distillation volume recovery @ 370^0C	% vol. (min)	95
	c. Kinematic Viscosity @ 40 Degree C	cSt	2.0 – 5.0
	d. Density @ 15 Degree C	kg/m^3	820 – 860
	e. Pour Point		
	- Summer	Degree C (max)	15
	- Winter	Degree C (max)	03
	f. Cold Filter Plugging Point		
	- Summer	Degree C (max)	18
	- Winter	Degree C (max)	06
	g. Flash Point (Abal)	Degree C (max)	35
	h. Lubricity WSD 1.4 @ 60 Degree C	Microns (max)	460
2.	HEATING VALUE		
	a. Higher Heating Value (HHV)	Kcal/Kg	11,000
	b. Lower Heating Value (LHV)	Kcal/Kg	10,300
3.	ACIDITY		
	a. Inorganic	mg KOH/g	Nil
	b. Total	mg KOH/g	0.2 (max.)
4.	Copper Strip Corrosion 3 hours @100^0C	No.	1 (max)
5.	RCR on 10% residue	% wt.	0.3 (max)
6.	CONTAMINANTS		
	a. Ash	ppm (wt.)	100 (max)
	b. Sediments	% wt	0.05 (max)
	c. Total Sulphur	% wt	0.05 (max)
	d. Water Content	% volume	0.05 (max)
	e. Trace Metals		
	- Na + K	ppm (wt)	0.30 (max)
	- Vanadium	ppm (wt)	0.50 (max)
	- Lead	ppm (wt)	0.50 (max)
	- Calcium	ppm (wt)	2.0
	- Ni + Zn	ppm (wt)	Nil
7.	Nitrogen content (FBN)	% wt.	0.015

TABLE-3 **ANNEXURE-IV-3**

PROPOSED COAL CHARACTERISTICS FOR NORTH KARANPURA STPP (3 x 660 MW)

S.No.	Characteristics (as received basis)	Range of 95 % coal supplies			Range of 5 % coal supplies
		Column - 1	Column - 2	Column - 3	
1.0	PROXIMATE ANALYSIS	Design	Worst	Best	
1.1	Total Moisture (%)	15	18	12	12-18
1.2	Ash (%)	40	46	36	33-46
1.3	Volatile Matter (%)	19	18	22	23-18
1.4	Fixed Carbon (%)	26	18	30	31-18
1.5	Total (%)	100	100	100	
2.0	ULTIMATE ANALYSIS				
2.1	Carbon (%)	29.73	23.08	37.32	40.62-23.08
2.2	Hydrogen (%)	3.7	3.54	3.92	4.02-3.54
2.3	Sulphur (%)	0.5	0.6	0.4	0.4-0.6
2.4	Nitrogen(%)	1.8	1.45	1.6	1.4-1.45
2.5	Oxygen(%)(By difference)	8.66	6.7	8.32	8.12-6.7
2.6	Carbonates (%)	0.58	0.6	0.4	0.4-0.6
2.7	Phosphorous(%)	0.03	0.03	0.04	0.04-0.03
2.8	Total Moisture (%)	15	18	12	12-18
2.9	Ash (%)	40	46	36	33-46
	Total	100	100	100	
2.10	GCV (Kcal/Kg)	3300	2800	4000	4300-2800
2.11	Hard Grove Index	55	50	60	50-65
3.0	ASH ANALYSIS				
3.1	Silica (%)	59.79	61.3	56.7	62-56
3.2	Alumina(%)	25.36	28	23.5	28-23
3.3	Iron Oxide (%)	7.2	6	10	6-10
3.4	Titania	1.2	1	1.5	1-1.7
3.5	Phophoric Anhydride (%)	2.6	1.5	3	1-3
3.6	Lime (%)	0.88	0.5	1.5	0.5-1.7
3.7	Magnesia (%)	0.55	0.4	1	0.4-1.1
3.8	Sulphuric Anhydride (%)	1.2	0.5	1.4	0.5-1.7
3.9	Alkalies (by difference)	1.22	0.8	1.4	0.6-1.8
	Total	100	100	100	
4.0	ASH FUSION RANGE				
	REDUCING ATMOSPHERE				
4.1	Initial Deformation Temp.(oC	1100	1100	1100	1100-1150
4.2	Hemispherical Temp. (oC)	1300	1250	1350	1250-1400
4.3	Fusion Temperature (oC)	1400	1400	1400	1400-1450

ANNEXURE-IV-4

TABLE – 4

TYPICAL IMPORTED COAL AND ASH CHARACTERISTICS

Sl.No.	Characteristics (as received basis)	Imported Coal	
		Worst	**Best**
1.0	**Proximate Analysis**		
1.1	Total Moisture (%)	20	16
1.2	Ash (%)	10	10
1.3	Volatile Matter (%)	30	45
1.4	Fixed Carbon (%)	40	29
1.5	Total (%)	100	100
2.0	**Ultimate Analysis**		
2.1	Carbon (%)	56.4	62.4
2.2	Hydrogen (%)	4.5	4.9
2.3	Sulphur (%)	0.9	0.8
2.4	Nitrogen (%)	0.9	0.5
2.5	Oxygen (%) (By difference)	7.3	5.4
2.6	Carbonates (%)	0	0
2.7	Phosphorous (%)	0	0
2.8	Total Moisture (%)	20	16
2.9	Ash (%)	10	10
	Total	100	100
2.10	GCV (Kcal/Kg)	5800	6500
2.11	Hard Grove Index	45	60
2.12	YGP (mg/kg)	100	70
3.0	**Ash Analysis**		
3.1	Silica (SiO2) (%)	32.74	34.94
3.2	Alumina(Al2O3) (%)	30.5	28.43
3.3	Iron Oxides(Fe2O3) (%)	18.2	15.2
3.4	Titania (TiO2)	1.56	1.76
3.5	Phosphoric Anhydride(P2O5) (%)	0.44	0.54
3.6	Lime (CaO) (%)	6.12	7.62
3.7	Magnesia (MgO) (%)	1.83	1.93
3.8	Sulphuric Anhydride (%)	6.95	7.65
3.9	Sodium Oxide (Na2O) (%)	0.3	0.4
3.10	Balance alkalies (by difference)	1.36	1.56
	Total	100	100
4.0	**Ash Fusion Temperature reducing temperature**		
4.1	Initial deformation Temp (ºC)	1100	1250
4.2	Hemispherical Temp. (ºC)	1300	1350
4.3	Flow Temp. (ºC)	1400	1400

SECTION-C

SPECIFIC TECHNICAL REQUIREMENT

SPECIFIC TECHNICAL REQUIREMENTS.

The requirements in this section are specific for this project and shall over-ride the specification under section-D in case of any contradiction.

1) For Actuator selection, bidder to take care of clause no. 5.00.00 at Section III-C08, NTPC spec. Attached in subsequent part of this section (Section-C)

2) Bidder to note that data sheet-B, Format "Schedule of submission of Drawings / Documents, Equipment Manufacture, Inspection and Despatch" enclosed in Section-D, to be signed and stamped and submitted with the bid. Quality Plan enclosed in Volume-IIB should be furnished duly signed and stamped. NO DEVIATION IS ACCEPTABLE.

3) All the formats in Volume-III should be filled-up and furnished with the bid, complete in all respect. Catalogue, Leaflets related with the models of Control Valves as well as each Accessory must be furnished with the offer. In the absence of those, the bid would be considered incomplete and liable for rejection.

4) The Hook-up diagram for Control valve is attached in Section-C. The Bidder's scope starts from isolation valve at Inst. Air Supply header. The suitable Connector required for connection of pneumatic tubing to isolation valve at Inst. Air Header is also in bidder's scope. The connection details at inst air valve shall be furnished to the successful bidder after the award of contract.

5) Valve Body Sizes shall be quoted to take care of the specification requirements like parameters, and limitations of Fluid outlet velocities, Noise Level etc. **However Port (Trim) Sizes shall be selected to suit CV requirement for achieving percentage valve lift as per specification clause nos. 1.02.00 and its sub-clauses, furnished at section-C** (Control Valve and Actuators, Section III C-08, NTPC spec, Sec-VI, PART B, 8 sheets).

5a) **In case of any contradiction in requirements** of Control Valves between Spec. no. PES-145-06 enclosed in Section-D AND NTPC requirement of Control Valves at section-C (Control Valve and Actuators, Section IIIC-08, NTPC spec, Sec-VI, PART B), **the requirement of section -C shall prevail.**

6) Type of bonnet shall be according to the service condition. Extension bonnets shall be provided when the maximum temperature of the flowing fluid is greater than 280 Deg C.

7) Valve and actuator shall be designed for full differential pressure (Max. shut-off pressure).

8) Tolerances on end to end, center to center, center to face shall be in accordance with ASME B16.10.

9) Anticavitation trims shall be provided for valves with cavitation service and hardened trims for flashing service.

10) Valve type like cavitation/flashing/ high DP has been indicated in the data sheet. Bidder to offer the valve accordingly. However if process is Cavitating, although not indicated in the valve type, bidder to offer Anticavitation trim.

11) Noise abatement mentioned shall be obtained by valve body and trim design & not by any external means.

12) Control valve accessories shall be fitted on the valve body. Integral pneumatic tubing shall be ¼ " OD PVC coated copper, and fittings shall be of brass. Applicable accessories shall be terminated at the junction box (mounted on the body).

13) Type of flow action ("under the seat" or "over the seat") will be selected by the bidder. However wherever downstream side is subjected to vacuum, flow action shall be "flow to close" (over the seat). Specific mention for the same has not been made in the datasheets.

14) Trim material and body material has been specified in the Datasheets-A. Bidder to offer body material & trim material combinations equivalent or better than the material specified in Datasheets-A. Wherever there is deviation from the datasheets, bidder to furnish the documentary proof for confirming superior trim material/ body material selection along with their offer. BHEL/NTPC reserves the right to accept/reject any variation to the specification.

15) Trim supplied shall be suitable for quick changing and trim exit velocity shall be limited to avoid cavitation.

16) The sizing procedure followed shall be as per latest edition of ANSI/ISA or equivalent standard.

17) The End Connections Shall Be Socket Welded For Sizes Below 50NB And Butt Welded For Sizes 50NB And Above.

18) Not Applicable

19) Facility to adjust the maximum travel of stem & starting point of travel shall be incorporated.

20) **Bidder to furnish the list of all control valves for which Cv test is to be carried. Cv test shall be carried out for each type of control valve(of same size,Cv,trim characteristics). Cv test reports shall be verified by BHEL/NTPC.Type test certificate shall also be acceptable.Bidder to note that only those type test reports for same type of control valves shall be offered for verification which are not older than 3 years from the date of Part 1 opening (receipt of technical unpriced offer).**

In case the CV Type Test reports are found unacceptable to BHEL/Customer at any stage, the bidder shall conduct the test without any price/delivery implication to BHEL/End User.

21) Calculation of Cv, noise level, valve outlet velocity, trim exit velocity, actuator sizing, data sheet-c in line with data sheet-A of specification, dimensional drawings / edge preparation details, etc shall be submitted for BHEL/NTPC review and approval, to reach BHEL within 15 days after receipt of LOI.

22) Selection of valves and actuators are bidder's responsibility. Any change in selection of type of valve / sizing / percentage opening, calculations, QP, etc., if desired by BHEL / customer during approval of the documents after award of contract, without major changes in process parameters as per tender specification, shall be carried out without any commercial implication and time delay.

23) Limit switch, position feedback shall be terminated up to JB by 0.5 mm2/PVC/Cu/1.1kv/FRLS shielded control cables. Solenoid valve shall be terminated by 2.5 mm2 size cable.

24) SS nameplate for control valve shall include tag no./kks no./sl. No./body material /size/press rating/trim material/trim type/action on air failure/diaphragm air pressure at full open and close condition.

25) Open to close and close to open time of pneumatic actuator (modulating type) shall be less than 10 sec. Bidder to include volume booster if required to achieve fast response time<10 sec.

26) Specification of electrical actuator shall not be considered.

27) Hand wheel shall have open/close direction.

28) Air filter regulator shall be designed for an inlet pressure of 5-8 kg/cm2.

29) Limit switch shall be designed for 1, 00,000 operations.

30) Expander/reducer shall be in BHEL's scope of supply.

31) JB shall be 36 ways as per enclosed hook-up diagram.

32) Pneumatic connection: for each control valve 25 meters length (for each leg of $\frac{1}{4}$" size light drawn tempered) copper tubing conforming to ASTM B75 shall be used. Thickness shall not be less than 0.065 inch and shall be PVC coated. Fittings to be used with copper tubes shall

be cast brass, screwed type including SS connection to suit 15 NB size screwed root valves (as per IS-554). Copper tubes shall be provided for connection between air filter regulators & root valves.

33) Inspection shall be carried out in line with approved drawing/ data sheet/ QP & specific technical requirements

34) Third party inspection: customer shall witness the inspection for control valves and Cv test at the manufacturer's works/ FCRI, PALAKKAD. Bidder to inform 15 days before the date of inspection.

35) In case during erection/commissioning of the control valve, any spares are required which have not been specified in the start-up/commissioning spares list, the same will have to be supplied by the bidder free of cost.

36) **SPARES:** The following spares are required to be offered

(A) **Mandatory spares to be considered as separate package. Mandatory spares to be packed in different colour & shipped separately. Marking on mandatory spares must be in different colour from main supply so that these are easily identifiable at site.**

(B) **Recommended Spares:**

In addition to the Mandatory spares mentioned, the bidder shall also furnish a List of Recommended spares for 3 years of normal operation of the Control valves / Accessories. BHEL/NTPC reserves the right to buy any or all of the recommended spares.

The prices of these spares will remain valid for a period of minimum 6 months after the placement of order.

(C) **Start-up & Commissioning Spares:**

Start-up and Commissioning spares are those spares, which may be required during the start-up and commissioning of the Control Valves. All start-up spares, which are supplied under this contract, shall be strictly interchangeable with the parts for which they are intended for replacements. The format for price schedule to be filled-up by the bidder is enclosed in Volume-III

The Start-up and commissioning spares indicated by the bidder shall be a part of the main Control valves supply. However bidder to indicate prices separately. The list of these spares required is enclosed in the section-D of this specification.

37) Bidder to indicate the service life expectancy period for the spare parts under normal working conditions. The spares shall be treated and packed for long storage, under climatic conditions prevailing at site. Small items shall be packed in sealed transparent plastic bags with desiccators' packs as necessary.

38) **SMART POSITIONER**

i) The smart positioner shall accept 4-20 mA signal from the control system as input and provide a compatible signal for driving the pneumatic actuator.

ii) In addition to the electrical-to-pneumatic signal conversion and positioning functions, it shall also perform detailed diagnostics & make available the actuator/control valve faults via hart interface. The hart signal for the detailed faults shall be superimposed on the 4-20 mA control signal itself. The faults to be covered shall include valve jamming, air supply failure, leakage etc.

iii) It shall have facility of characterisation of the valve (i.e. equal percentage, quick opening, linear, etc.) in the positioners itself.

iv) Bidder to include in their offer, if any software is required to be installed on the HMS PC (HMS in BHEL'S scope) to communicate with the smart positioners and to access the diagnostic features of the smart positioners. Bidder to furnish price for such software in their offer.

v) The positioner shall have the facility of detection of control signal failure and making the valve either stayput/open/close as per process requirement upon this condition.

vi) The smart positioner shall have the fail-freeze & fail safe feature.

vii) The offered smart positioner for the valve shall be suitable for Universal type of Hand Held calibrator

39) **Documentation:**

(A) Along with the bids: following documents for respective projects separately

a) Signed and stamped compliance certificates in attached format (VOL.-III).

b) Schedule of prices in attached format (VOL.-III).

c) Schedule of submission of Drg. / Doc, Equip. Manufacture, Inspection and Dispatch.

d) Inspection schedule

e) Documents supporting his experience of supplying a similiar service valve in thermal power plant application for the offered valve.

(B) After the award of contract:

The documentation as listed below will separate for respective projects

6 sets of the following documents + 3 sets of CDs to be enclosed with the bids for Approval:

a. Assembly (dimensional) drawings.
b. Valve Edge preparation details.
c. Data sheet-C completely filled-up..
d. Hook-up diagram of Control Valve with Actuator & Accessories.
e. Valve & Actuator assembly dimensional drawings with weights.
f. Quality Plan duly signed and stamped.
g. All calculations like CV, Noise Level, Valve Outlet Velocity, Actuator sizing etc.
h. All relevant catalogues for the models of the valves as well as accessories finalized.
i. Bar chart to indicate the time schedule for procurement, manufacture, testing and dispatch.

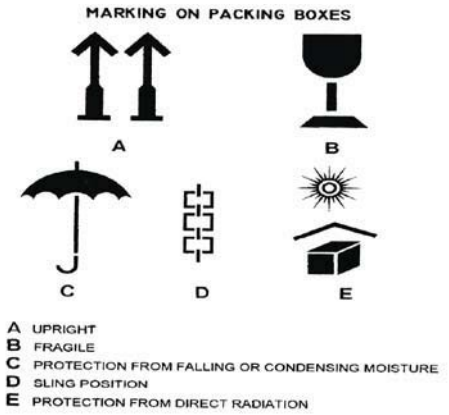
(C) Final documentation:

Copies of documents / drawings to be furnished by the successful bidder shall be as follows:

a. Assembly (dimensional) drawings, calculations, edge preparation details/datasheets/QP for approval – 15 sets.
b. Category-I & IV approved final drawings /datasheets – 15 sets with CD – ROMS.
c. Valve sizing calculations, noise level calculations and outlet velocity calculations – 15 sets with 2 CD – ROMS
d. Test certificates – 15 sets.
e. "As built" drawings – 15 sets.
f. Operation & maintenance manuals – 15 sets.

Guidelines for Packing

- ✓ After inspection of control valves assembly. Smart Positioner along with Pressure Gauge shall be disassembled & packed separately.
- ✓ Threaded connection of Smart Positioner & Pressure Gauge shall be shipped with the end caps fitted to avoid any damage.
- ✓ Instructions with sketch for mounting the Smart Positioner & Pressure Gauge shall be sent along with the aforesaid accessories.
- ✓ Packing of the control valves and Smart Positioner along with Pressure Gauge shall be done in separate wooden boxes/cases in order to avoid damage during transit and also during storage at site in tropical climatic conditions for a period of 18-24 months.
- ✓ All valves & smart positioner along with pressure gauges shall be packed properly with quality wooden planks with proper wooden frame support. Moreover the valves are internally covered with polythene sheets to protect from the water and moisture entry.
- ✓ Stronger shock absorbing cover material like expanded Polyurethane which can take any direct impact on it shall be used for packing
- ✓ Proper reaper support to be provided in the packing and Valve assembly to be aligned properly to avoid the damage of accessories during transit due to vibration effect.
- ✓ Marking for Fragile & Condensing environment shall be done on the packing box.



<u>The Following Details are to be marked on the Packing Cases</u>

- ✓ Address of consignee
- ✓ Purchase order no.
- ✓ Description of items or title of packing list
- ✓ Weight
- ✓ Dimension of the Box
- ✓ Marking showing upright position
- ✓ Marking showing sling position
- ✓ Marking showing umbrella (i.e. for machines/components to be stored under covered storage)

CONTROL VALVES, ACTUATORS & ACCESSORIES

1.00.00	**CONTROL VALVES, ACTUATORS & ACCESSORIES**
1.01.00	**General Requirements**
1.01.01	The control valves and accessories equipment furnished by the Bidder shall be designed, constructed and tested in accordance with the latest applicable requirements of code for pressure piping ANSI B 31.1, the ASME Boiler & pressure vessel code, Indian Boiler Regulation (IBR), ISA, and other standards specified elsewhere as well as in accordance with all applicable requirements of the "Federal Occupational Safety and Health Standards, USA" or acceptable equal standards. All the Control Valves, their actuators and accessories to be furnished under this Sub-section will be fully suitable and compatible with the modulating loops covered under the Specification.
1.01.02	All the control valves and accessories offered by the Bidder shall be from reputed, experienced manufacturers of specified type and range of valves.
1.01.03	For special type of control valves such as combined pressure and temperature control valves for Aux PRDS application, separator drain control valves, refer to the corresponding mechanical sections.
1.02.00	**CONTROL VALVE SIZING & CONSTRUCTION**
1.02.01	The design of all valve bodies shall meet the specification requirements and shall conform to the requirements of ANSI (USA) for dimensions, material thickness and material specification for their respective pressure classes.
1.02.02	The valve sizing shall be suitable for obtaining maximum flow conditions with valve opening at approximately 80% of total valve stem travel and minimum flow conditions with valve stem travel not less than 10% of total valve stem travel. All the valves shall be capable of handling at least 120% of the required maximum flow. Further, the valve stem travel range from minimum flow condition to maximum flow condition shall not be less than 50% of the total valve stem travel. The sizing shall be in accordance with the latest edition of ISA handbook on control valves. While deciding the size of valves, Bidder shall ensure that valves trim exit outlet velocity as defined in ISA handbook does not exceed 8 m/sec for liquid services, 150 m/sec. for steam services and 50% of sonic velocity for flashing services. Bidder shall furnish the sizing calculations clearly indicating the outlet velocity achieved with the valve size selected by him as well as noise calculations, which will be subject to Employer's approval during detailed engineering.
1.02.03	Control valves for steam and water applications shall be designed to prevent cavitation, wire drawing, flashing on the downstream side of valve and down stream piping. Thus for cavitation/flashing service, only valve with anti cavitation trim shall be provided. Detailed calculations to establish whether cavitation will occur or not for any given application shall be furnished.
1.02.04	Control valves for application such as SH Spray Control, RH spray Control, Heavy Oil Heating, pressurizing and Control system, HP/LP heater Emergency level control, Emergency Make-up to condenser hotwell, GSC minimum flow, Deaerator Drain to Condenser Hotwell, Condensate spill to condensate reserve tank, condenser normal make-up and valve gland sealing supplying pressure control, CEPS minimum flow control, BFP circulation control valve shall have permissible leakage rate as per leakage Class V. All other control valves shall have leakage rate as per leakage Class-IV.
1.02.05	The control valve induced noise shall be limited to 85 dBA at 1 meter from the valve surface under actual operating conditions. The noise abatement shall be achieved by valve body and trim design and not by use of silencers.

2.00.00 VALVE CONSTRUCTION

2.01.00 All valves shall be of globe body design & straightaway pattern with single or double port, unless other wise specified or recommended by the manufacturer to be of angle body type. Rotary valve may alternatively be offered when pressure and pressure drops permit.

2.02.00 Valves with high lift cage guided plugs & quick-change trims shall be supplied.

2.03.00 Cast Iron valves are not acceptable.

2.04.00 Bonnet joints for all control valves shall be of the flanged and bolted type or other construction acceptable to the Employer. Bonnet joints of the internal threaded or union type will not be acceptable.

2.05.00 Plug shall be of one-piece construction cast, forged or machined from solid bar stock. Plug shall be screwed and pinned to valve stems or shall be integral with the valve stems.

2.06.00 All valves connected to vacuum on down stream side shall be provided with packing suitable for vacuum applications (e.g. double vee type chevron packing)

2.07.00 Valve characteristic shall match with the process characteristics.

2.08.00 Extension bonnets shall be provided when the maximum temperature of flowing fluid is greater than 280 deg. C.

2.09.00 Flanged valves shall be rated at no less then ANSI press class of 300 lbs.

3.00.00 VALVE MATERIALS

Sr. No.	Service	Body material	Trim Material
1	Non-corrosive, non-flashing and non-cavitation service except DM water	Carbon steel ASTM-A216 Gr. WCB for fluid temperature below 275 Deg. C Alloy steel ASTM-A217Gr. WC9 for fluid temperature above 275 Deg. C	316SS stellited with stellited faced guide posts and bushings.
2.	Severe flashing/cavitation services	Alloy steel ASTM-A217 Gr. WC9	440 C
3.	Low flashing/cavitation service	Alloy steel ASTM-A217 Gr. WC6	17-4 PH SS
4.	DM water service	316 SS	316 SS

NOTE Valve body rating shall meet the process pressure and temperature requirement as per ANSI B16.34.

However, Bidder may offer valves with body and trim materials better than specified materials and in such cases Bidder shall furnish the comparison of properties including cavitation resistance, hardness, tensile strength, strain energy, corrosion resistance and erosion resistance etc. of the offered material vis-a-vis the specified material for Employer's consideration and approval.

4.00.00 END PREPARATION

Valve body ends shall be either butt welded/socket welded, flanged (Rubber lined for condensate service) or screwed as finalized during detailed engineering and as per Employer's approval. The welded ends wherever required shall be butt welded type as per ANSI B 16.25 for control valves of sizes 65 mm and above. For valves size 50 mm and below welded ends shall be socket welded as per ANSI B 16.11. Flanged ends wherever required shall be of ANSI pressure-temperature class equal to or greater than that of the control valve body.

5.00.00 VALVE ACTUATORS

All control valves shall be furnished with pneumatic actuators except for pressure and temperature control valve for auxiliary PRDS application (electro-hydraulic / pneumatically operated) and separator drain control valve (electro-hydraulic type).The Bidder shall be responsible for proper selection and sizing of valve actuators in accordance with the pressure drop and maximum shut off pressure and leakage class requirements. The valve actuators shall be capable of operating at 60 deg.C continuously.

Valve actuators and stems shall be adequate to handle the unbalanced forces occurring under the specified flow conditions or the maximum differential pressure specified. An adequate allowance for stem force, at least 0.15 Kg/sq.cm. per linear millimeter of seating surface, shall be provided in the selection of the actuator to ensure tight seating unless otherwise specified.

The travel time of the pneumatic actuators shall not exceed 10 seconds.

6.00.00 CONTROL VALVE ACCESSORY DEVICES

6.01.00 All pneumatic actuated control valve accessories such as air locks, hand wheels/hand-jacks, limit switches, microprocessor based electronic Positioner, diffusers, external volume chambers, position transmitters (capacitance or resistance type only), reversible pilot for Positioner, tubing and air sets, solenoid valves and junction boxes etc. shall be provided as per the requirements.

7.00.00 SPECIFICATIONS FOR MICROPROCESSOR BASED ELECTRONIC POSITIONER

1	Electrical	a) Input Demand Signal	4-20 mA
		b) Power Supply	Loop Powered from the output card of Control System.
		c) HART Protocol	Compatibility for Remote Calibration & Diagnostics (Super-imposed HART signal on input Signal (4-20 mA)
		d. Valve position sensing	Position sensing, 4-20 mA output signal to be provided for control system.
2	Environment	a) Operating temp.	(-)30 To 80 Deg. C
		b) Humidity	0-95 %
		c) Protection class	IP-65 Minimum

3	Software for Configuration and Diagnostics	Software	Windows based software. Software shall meet the requirements for Configuration, Diagnostics, Calibration and Testing of the actuator.
		Diagnostic/Test features	Advanced diagnostic features like Stroke counter or Travel counter, Leakage in actuators, Valve Signature analysis, Step Response test, Valve friction /Jamming detection etc to be provided.
4	Test reports/ Certificates	Factory Valve Signature Tests Reports (Pr Vs Valve travel and Travel Vs I/P signal) are to be provided.	
		Test certificates as per Manufacture Standard/Relevant Standard are to be submitted.	
5	Configuration/ Calibration.	Remote & Local Calibration, Auto & Manual Calibration shall be possible.	
6	Operating Range	Full range/ Split range.	
7	Modes	Valve Action	Direct / Reverse Valve Action
		Flow Characterization	Possible to fit Valve Characteristic Curves- Linear , Equal percentage etc.
8	Fail Safe/Fail Freeze	Fail Safe/Fail Freeze feature is to be provided. (In case the fail freeze feature is not intrinsic to the positioner, Bidder shall achieve the same externally through solenoid valve connected in the pneumatic circuit).	
9	Pneumatic	Air capacity	Sufficient to handle the valves & actuators selected/ Boosters to be supplied, if required.
		Air pressure	To suit the air supply pressure/quality available.
		Process connection	¼" NPT
10	Performance	Characteristic deviation	<=0.5 % of span.
		Ambient temp effect	<=0.01 %/ deg C or better.

10	EMC & CE Compliance	Required to International Standard like EN/IEC.	EN50081-2 & EN50082 or equivalent.
11	Accessories	In-built Operator Panel	Display with push buttons for configuration and display on the positioner itself (Password protected/Hardware lock).
		Hand Held Hart Calibrator	Universal Hart Calibrator to be provided (for quantity, refer Part-A: Contract quantities of the specification).
		Press Gauge Block	For supply & output pressures, Air Filter Regulator and other accessories shall be provided on as required basis for making system complete.
		Electrical Cable Entry	1/2'"NPT, side or bottom entry to avoid water ingress.
		Valves Mounting Assembly	For Sliding Stem/Rotary/Single acting/Double acting actuators on as required basis

*** Note**:

The HART signals shall be picked up from marshalling terminals of DDCMIS (SG/TG DDCMIS as well as BOP DDCMIS), as applicable. The details of the above mentioned HART management system specification are mentioned in HART system (Annexure IIIC-02C to DDCMIS).

The positioners shall be monitored from this HART management system .To achieve this, Bidder shall provide the necessary software to achieve the functionalities described above under "Remote Configuration and Diagnostics", and this software shall be loaded in the HART management system.

8.00.00 **TEST AND EXAMINATION**

All valves shall be tested in accordance with the quality assurance programme agreed between the Employer and Contractor, which shall meet the requirements of IBR and other applicable codes mentioned elsewhere in the specifications. The tests shall include but not be limited to the following:

8.01.00 Non Destructive Test as per ANSI B-16.34.

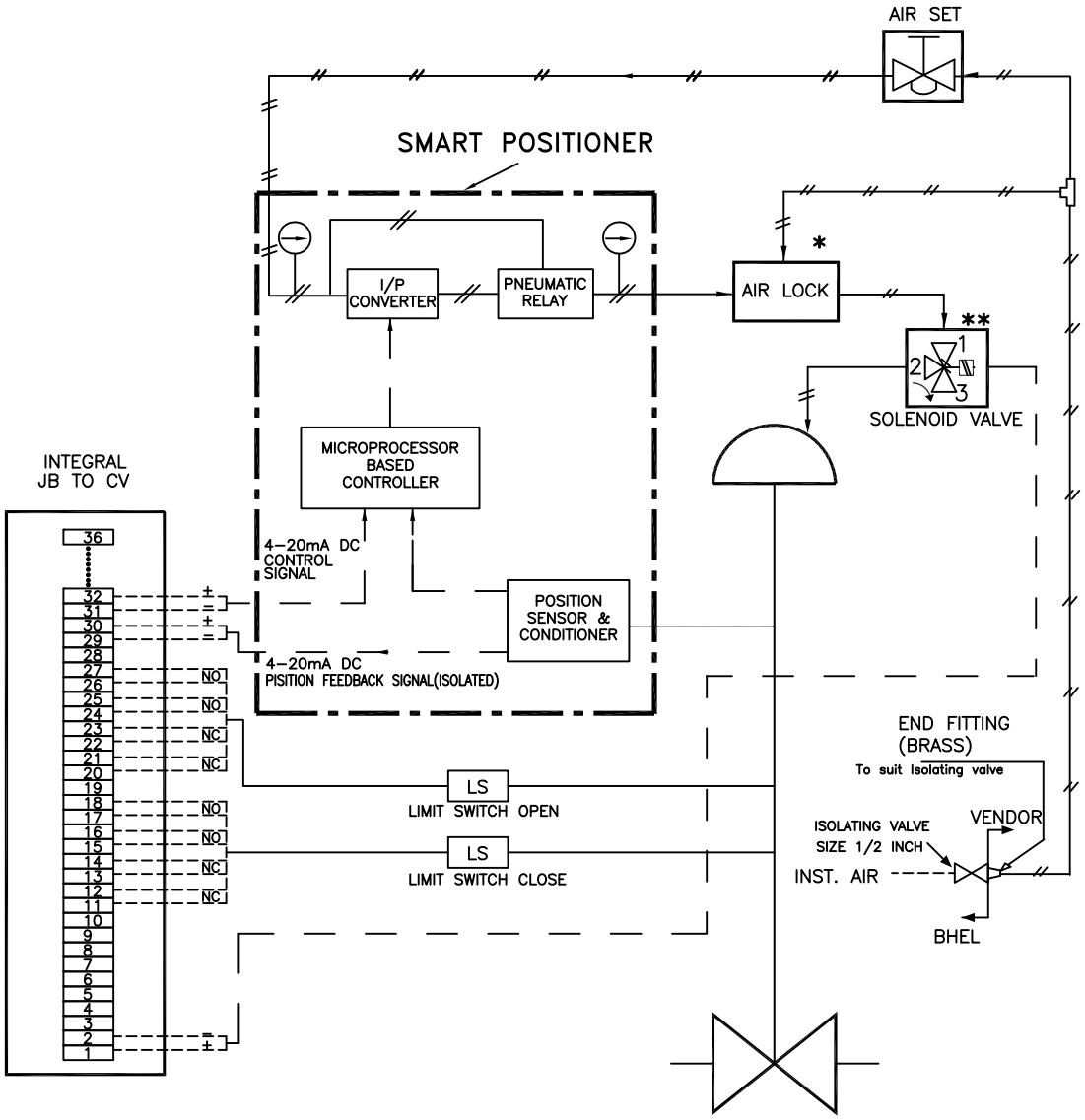
8.02.00 Hydrostatic shell test in accordance with ANSI B 16.34 prior to seat leakage test.

8.03.00	Valve closure test and seat leakage test in accordance with ANSI-B 16.34 and as per the leakage class indicated above.
8.04.00	Functional Test: The fully assembled valves including actuators control devices and accessories shall be functionally tested to demonstrate times from open to close position.
8.05.00	CV Test: Please refer Cl No. 1.00.00, Sub-section-IV: I9 (Type test requirements), Control Valves. Bidder shall furnish all the control valves under this main plant package as finalized during detailed engineering stage without any price repercussions whatsoever depending on the process requirements. All the control valves provided by the Bidder for this project shall meet the specifications requirements specified herein. Specification for control valves in this Sub-section has to be read in conjunction with other relevant Sub-sections of this specification.

TITLE

CONTROL VALVE HOOK–UP DIAGRAM WITH SMART POSITIONER

3X660 MW NORTH KARANPURA



NOTE:–

1. SOLENOID VALVE WILL BE PROVIDED ONLY FOR ON/OFF DUTY VAVLVES & FOR CONTROL VALVES WHERE OPEN/CLOSE INTERLOCK IS REQUIRED AND INDICATED IN RESPECTIVE DATA SHEETS.
2. SOLENOID VALVES PORT CONDITION:
   PORT 1 & 2 SHAL BE CONNECTED UNDER DE–ENERGISED CONDITION.
   PORT 2 & 3 SHAL BE CONNECTED UNDER ENERGISED CONDITION.
3. FOR ON/OFF DUTY PNEUMATIC CONTROL VALVE,SMART POSITIONER SHALL NOT BE APPLICABLE.
4. JB TERMINALS SHALL BE CAGE CLAMP TYPE SUITABLE FOR 2.5 SQ. MM COPPER WIRE.
5. 15 METERS 1/4 " PVC COATED COPPER TUBING AND 1 SET OF FITTINGS TO BE SUPPLIED FOR EACH CONTROL VALVE FOR CONNECTION TO ISO VALVE AT INST AIR HEADER ON ONE END AND TO AIR LOCK RELAY/AIR FILTER REGULATOR ON THE OTHER END.
6. VOLUME BOOSTER ALL BE PROVIDED.

** APPLICABLE TO VALVES WHERE OPEN/CLOSE ACTION REQUIRED ON INTERLOCK CONDITION

* APPLICABLE AS PER REQUIRED VALVE POSITION IN DATA SHEETS ON SIGNAL AIR FAILURE & Valve Position Electric Signal Failure (4–20mA).

SECTION – D

- **EQUIPMENT SPECIFICATION**
- **DATA SHEETS – A & B**
- **DATA SHEETS FOR ACCESSORIES**
- **DATA SHEETS – C**
- **QUALITY PLAN**
- **BILL OF QUANTITY**
- **SPARES**
- **PAINTING PROCEDURE**
- **SCHEDULE OF SUBMISSION OF DRAWINGS / DOCUMENTS, EQUIPMENT MANUFACTURE INSPECTION AND DESPATCH**

SECTION-D

EQUIPMENT SPECIFICATION

1.0 SCOPE

This specification covers the Design, Manufacture, Inspection and Testing at the manufacturer's works, proper packing for transportation and delivery to site of Control valve (with Pneumatic/Electric Actuator) for use in Utility/Captive Power Station/Combined Cycle Station.

2.0 CODES AND STANDARDS

2.1 All the equipments specified herein shall comply with the requirements of the latest issue of the relevant National and International standards.

2.2 The Design and Materials used for the components shall also comply with the relevant National and International standards.

2.3 As a minimum requirement, the following standards shall be complied with :

Indian Boiler Regulation (IBR)		
Allowable Seat leakage	:	ANSI-B16.104 / FCI-70.2
Pressure & Temperature ratings	:	ANSI-B16.34
Enclosure class	:	IEC-144 / NEMA / IS-13947
Control Valves	:	ISA S-75
Electric Motor operated Actuators	:	IS-9334

3.0 TECHNICAL REQUIREMENTS

The Control valve, Actuator and the accessories shall be suitable for continuous operation under an ambient temperature of 0-55°C and Relative Humidity of 0-95% unless specified otherwise in volume IIB Section-B or Section-C.

3.1 Control Valve

The control valve shall be suitably designed for the operating conditions and system characteristics as specified in the Data Sheet-A.

3.1.1 The control valve shall be of globe body design with single port. The valve trim, shall be suitable for quick removal without any cutting or welding.

3.1.2 The material of body, internals and packing shall be as specified in the data sheets. Alternatives, considered more suitable for service specified may be given as alternative offer, along with adequate justification. However main offer shall totally meet specification requirements. Asbestos shall not be used for the packing or any other component.

3.1.3 The valve bonnet and packing shall be suitable for the service conditions as in Data Sheet-A. Gland sealed type bonnets are not acceptable. Double packing is mandatory for applications involving vacuum service. Bonnets having teflon packing shall have valve stem finished to 2- 4 microns. Packing material requiring lubrication will not be acceptable. Justification for proper selection of bonnet & packing shall be furnished in the bid.

3.1.4 The valve end connection as specified in Data Sheet-A shall conform to ANSI B16.25 for Butt Weld connection and ANSI B16.5 for flanged ends. End to end dimension shall be as per ANSI 16.10.

3.1.5 The valve seat leakage shall be as per ANSI B16.104 / FCI-70.2. The leakage class shall be as per Data Sheet-A.

3.1.6 The valve body shall have the direction of flow embossed on all valves.

3.1.7 The sizing shall conform to the requirements of ANSI/ISA(S75- 01), and the valve capacity shall be selected so as to meet the following:

Valve with Linear characteristic.	-	Normal Flow (Design Point)	:	70-75% valve lift.
	-	Max. Flow	:	90% valve lift.
	-	Min. Flow	:	>10% valve lift.
Valve with Equipercentage Characteristic	-	Normal Flow (Design Point)	:	75-85% valve lift.
	-	Max. Flow	:	90% valve lift.
	-	Min. Flow	:	>10% valve lift.
ON/OFF Quick open Characteristic	-	1.1 times the CV calculated on the basis of maximum flow condition.		

3.1.8 Calculation for valve sizing, velocity and noise shall be subject to purchaser's approval during contract stage. However responsibility of proper selection and design for the duties specified lies with the vendor. Any modifications required to be done on the valves or actuators & accessories to achieve satisfactory performance of the control system shall be done without any commercial implication.

3.1.9 Suitable justification and evidence shall be furnished regarding proper selection of the valve.

3.1.10 The valve outlet velocities shall be limited to the following values, unless otherwise specified in the Data sheet-A.

i)	Liquid service	<=	7 Metres/Sec.
ii)	Steam service	<=	1/3 Sonic velocity in the flow medium.

3.1.11 For flashing duty, the trim design shall be such that the vapour bubbles are kept away from valve body.

3.1.12 For cavitation service, the trim design shall be of multistage pressure drop type, so as to avoid cavitation altogether, instead of keeping cavitation away from valve parts.

3.1.13 In case of predicted noise level above 85 dBA, suitable low noise trim or inbuilt diffusers shall be provided to bring down the noise level below 85dBA.

3.1.14 The equivalent weighted sound level measured at 1.5M. above floor level in elevation and one metre horizontally from the control valve expressed in decibels to a reference of 0.0002 microbar shall not exceed 85 dBA (without pipe insulation). The offer shall include noise prediction calculations for each valve.

3.1.15 In case of wrong selection/maloperation of valve and for associated actuator during guarantee period, the vendor shall replace the valve suitably with a modified/new valve of design as approved by purchaser and all the expenses for replacement, rectification/modification including transportation both ways will be at vendor's expenses.

3.2 Pneumatic Actuator

The pneumatic actuators shall be employed for modulating or open/close duty, as specified in Data Sheet-A. The bidder shall be responsible for proper selection and sizing of valve actuators in accordance with the pressure drops and shut off pressure.

3.2.1 The pneumatic spring opposed diaphragm actuator for modulating duty shall be capable of positioning the associated valve at desired opening for all the operating conditions specified.

3.2.2 The pneumatic actuator for open/close duty shall be suitable for fast opening/closing of the associated valve.

3.2.3 The actuator design shall allow valve assembly to be mounted at 45° inclination on either side in the vertical plane.

3.2.4 The actuators shall be suitably sized to ensure that the associated valve travel time from full open to full closed position and vice versa is less than 20 seconds under the most stringent service conditions.

3.2.5 The actuator shall be painted with epoxy based paint.

3.3 Accessories for Control valve with Pneumatic Actuator

The bidder shall offer all the accessories as specified in the Data Sheet - A for the Pneumatic Actuators under modulating or OPEN/CLOSE duty. The accessories specified shall be supplied duly mounted on the valve actuator and piped with PVC covered copper tube and flare less brass fittings (Refer typical hook up diagram in sheet 12 of 12).

3.3.1 Hand wheel

Hand wheel shall have OPEN & CLOSE direction marking and clockwise rotation as viewed from front shall close the valve. The hand wheel shall have a circular stainless steel plate with Tag number and service.

3.3.2 Local Position Indicator

Each actuator shall be provided with a mechanical pointer attached to stem, moving over a graduated scale with markings, for OPEN, 25%, 50%, 75%, CLOSE positions.

3.3.3 Position Transmitter

The position transmitter shall be supplied as indicated in Data Sheet-A. The electronic position transmitter shall be non-contact type with 4-20 mA DC 2-wire output suitable for 12-50V DC supply. The resistance type position transmitter shall have 0-100 ohm variation for valve position change of 0-100%. The position transmitters of both types shall have accuracy and enclosure class. Necessary cable glands shall be supplied.

3.3.4 Air Filter Regulator

Instrument quality air at suitable pressure of 5 .5 Kg/Cm2(g) to 7 Kg/Cm2(g) s hall be s upplied to each valve through air filter regulator. The filter regulator shall include an inbuilt b low-down valve, 5 micron size filter. The design pressure for regulator shall be 7 Kg/cm2g. The Air filter regulator shall be s elected t o meet the r equirements o f positioner/actuator, E/P c onvertor and air-lock. The f low capacity of th e A ir filter regulator shall be v ariable with a k nob. O utput gau ge s hall b e provided wherever pneumatic positioner is not specified for the valve.

3.3.5 Air Lock Relay

Air lock relay shall re tain t he valve p osition stayput, in ca se of a ir supply failure a nd sh all re set automatically on res umption o f a ir supply. Air lo ck s hall hav e a thr eaded plug for e vacuating diaphragm air if required for local manual operation.

3.3.6 Sole noid Valves

Solenoid valves are meant for interlock & protection purposes overriding the controller signal, and/or to result stayput action on controller signal failure. The Solenoid valve shall be 3-way Universal type and the valve internals shall be of stainless steel. The coil shall have class-H insulation and rated for continuous AC/DC duty as specified in Data sheet-A. The enclosure shall be to I P-55. Cable gland shall be pr ovided for c able e ntry. The s olenoid shall in g eneral c onform to IS -8935. Th e s olenoid operation shall be universal type. The solenoid shall be suitable for 24V DC supply, unless specified otherwise in Data Sheet-A.

3.3.7 Limit Switches

Limit switches are required as specified in the data sheet-A. Each limit switch shall have 2NO+2NC contacts with c ontact r ating o f 5A at 2 40V AC/0.2A at 2 20V DC unless o therwise s pecified. The switch enclosure shall conform to IP-55. Each limit switch shall be supplied with cable glands.

3.3.8 I/P Converter

I/P Converters shall preferably be of force balance type and shall produce pneumatic output signal corresponding to i nput c urrent s ignal, also s pecified i n D ata S heet. Conv ertor el ectronics shall be protected against reverse connection of signal polarities and a separate external connection shall be provided to fa cilitate groun ding of in strument casing. Cable glands with neoprene gromets suitable for P VC c ables shall b e provided. I/P c onvertor s hall have span a djustment facility. I/P con vertor enclosure shall conform to IP-55 enclosure class.

3.3.9 Pos itioner

Positioner shall be suitable for accepting controller output signal 0.2-1.0 Kg/cm2, 0.2-0.6 Kg/cm2 or 0.6-1.0 Kg/cm2 as specified and give an output suitable for the actuator. Pneumatic positioner shall have 3 gauges. All g auges shall have metric sc ales. The po sitioner inp ut s ignal r ange s hall be adjustable. Wherever applicable, it shall be possible to bypass the positioner by means of a switch. Linearity and Hysterisis shall be as indicated in Data sheet-A

3.3.10 Elec tro pneumatic Positioner

In p lace of separate E/P Conv erter and pneumatic p ositioner a c ombined el ectro pneumatic positioner can also be supplied. The electro pneumatic positioner shall have 2 gauges.

3.3.11 J unction Box

Wherever specified, an integral junction box with all electrical accessories conduited up to JB shall be supplied. The junction box shall have two (2) cable glands for outgoing cables. Junction box shall have enclosure class of IP-55.

3.4 Guarantee & Performance

3.4.1 The overall performance of the control valve with pneumatic actuator assembly shall be as follows:-

i)	Hysteresis	:	± 1% of span
ii)	Linearity	:	± 2% of span
iii)	Sensitivity	:	± 0.5% of span.
iv)	Repeatability	:	± 1% of span
v)	Accuracy (Overall)	:	± 2% of span

3.4.2 The guarantee for the control valve, pneumatic actuator & accessories shall be for 12 months continuous operation from the date of commissioning, unless specified otherwise in VOL-IIB Section-B or Section-C.

3.5 Electric Actuator

The electric actuator shall be employed for modulating duty.

3.5.1 The actuator assembly shall be complete with drive motors, gears, hand wheel, signaling & switching units, associated control, integral starter, (when specified) and other accessories as required.

3.5.2 The Electric Actuator shall be capable of positioning the associated valve at the desired opening for all the operating conditions.

3.5.3 The motor shall meet the requirements of Current, torque, Axial thrust, Accelerating & stall time as imposed by the driven equipment.

3.5.4 The motor shall be suitable for direct on line starting.

3.5.5 Motors shall be suitable for inching & plugging duty operations.

3.5.6 The motors shall be capable of starting and accelerating to rated speed at 85% of rated voltage.

3.5.7 The motors shall be rated for continuous operations for modulating duty.

3.5.8 The motor shall operate satisfactorily under the following conditions:

i) ±10% supply voltage variation at rated frequency.

ii) -5% to + 3% variation in frequency at rated supply voltage.

iii) Simultaneous variation in voltage and frequency, the sum of absolute percentage not exceeding 10%.

3.5.9 The Actuator shall be suitable for mounting directly on the valve and shall be suitable for mounting in any position. Supports required for inclined mounting shall form part of supply of valve assembly.

3.5.10 The actuator shall be capable of producing the required torque and thrust at the output shaft for satisfactory operation of the associated valve.

3.5.11 Each actuator shall have a hand wheel for emergency operation. The hand wheel shall be designed such that it is declutched automatically when the power supply to the motor is restarted.

3.5.12 The hand wheel shall be so arranged that when looking from hand wheel, the valve is closed by rotating the hand wheel in clockwise direction.

3.5.13 Motor shall be totally enclosed conforming to IP-65 or better as per data sheet. The enclosure shall be suitable to protect the motor from leakage steam, water or oil from valve joints and glands.

3.5.14 Where flameproof enclosures are specified, it shall meet the specification IS-2148.

3.5.15 Insulation shall be at least class-B or better and shall be tropicalised to withstand the atmospheric condition.

3.5.16 The actuator shall be provided with antifriction bearing in grease filled cartridge.

3.5.17 Each actuator shall be provided with a mechanical position indicator to indicate accurately the valve position.

3.5.18 The integral starter, if specified in data sheet-A, shall be provided in weatherproof enclosure with protection class not less than IP-65 or better as per data sheet.

The integral starter shall consist of:

i) Mechanical & Electrically interlocked reversing contractors suitable for class AC4 duty or Thyristor as pet data sheet.

ii) Thermal overload relay.

iii) Step down control transformer with fuses.

iv) Interposing relay.

v) Monitoring relay..

vi) Open, Close & Stop push buttons.

vii) Indicating lamps.

viii) Local-Remote lockable selector switch with spare potential free contacts, wired for remote interface.

ix) A potential free contact shall be provided for remote annunciation of power failure/overload condition. The contact shall be SPDT, rated for at 5A 240V AC or 0.2A at 220V DC.

3.5.19 The actuator shall be suitably time rated for the duty cycle involved with the necessary number of starts per hour, but in no case, less than 1200 starts per hour.

3.5.20 The actuator shall be provided with a suitable control unit for receiving 4-20 mA signal from remote controller.

3.5.21 The servomotor gear should have self locking or suitable brake so as to maintain it's last position as and when the motor power is switched off.

3.5.22 Thermostat/Thermistor as specified in the data sheet shall be provided for sensing the winding temperature and giving trip command. The trip contact shall be change over type. The contact shall be wired up to the actuator terminal box.

3.6 Accessories for Control Valve with Electric Actuator

3.6.1 Torque Switches

i) Each actuator shall be provided with at least one open and one close torque switches each with 2 NO+2 NC contacts. The contacts shall be rated for 5A at 240V AC or 0.2A at 220V DC.

ii) The torque switches shall have a minimum accuracy $\pm$ 3% of set value.

iii) The torque switches shall be provided with calibrated knobs for setting desired torque. Separate knobs shall be provided for close and open torque switches.

iv) The torque switches shall be provided with mechanical latching device to prevent operation when unsealing from the positions. The latching device shall unlatch as soon as the valve leaves the end position. If such provision is not possible, the torque switches shall be bypassed by end position limit switches, which open on valve leaving end position. These limit switches are additional to the number of limit switches specified elsewhere.

v) The torque switches or worm gear shall be self-locking type so that when torque switch operates it remains operated until the actuator is operated in the reverse.

vi) The torque switch enclosure shall conform to IP-55.

3.6.2 Limit Switches

Each limit switch shall have 2NO+2NC contact with contacts rated for 5A 240V AC/0.2A 220V DC unless otherwise specified. The switch enclosure shall conform to IP-55. Each limit switch shall be supplied with cable glands.

3.6.3 Space Heater

A space heater shall be provided in limit switch and starter compartments to prevent condensation. This shall be suitable for the power supply specified in the data sheet. Where integral starters are provided the space heaters shall be wired to control supply within the actuator.

3.6.4 Remote Position Transmitter

The position transmitter shall be supplied as indicated in Data Sheet-A. The electronic position transmitter shall be non-contact type with 4-20mA DC 2-wire output suitable for 12-50V DC supply. The resistance type position transmitter shall have 0- 100 ohm variation for valve position change of 0-100%. The position transmitters of both types shall have ± 1% accuracy. The enclosure shall conform to IP-55. Necessary cable glands shall be supplied.

3.6.5 Wiring

i) The actuator and the accessories will be neatly wired up to the terminal boxes.
ii) The internal wiring shall be minimum of 1 mm^2 stranded PVC insulated copper conductor.
iii) The wiring shall be identified by means of numbered ferrules on both ends of all wires.

3.7 Terminal and Terminal boxes

3.7.1 Motor Terminal Box

i) The terminals, terminal boards, terminal boxes, winding tails and associated equipment shall be suitable for connection to supply system having short circuit capacity specified in data sheet and clearance time determined by the associated fuses.

ii) The terminals shall be stud type insulated from the frame. The insulation shall not be porcelain. The studs shall be of brass or stainless steel or phosphor bronze of adequate size.

iii) The terminal box shall be totally enclosed conforming to degree of protection IP-65.

3.7.2 Actuator Terminal Box

i) All terminals of limit and torque switches, space heater, position transmitters, thermostat/thermister shall be brought to a common terminal box. The enclosure shall be to degree of protection IP-65.

ii) Terminal board with plug in connector shall be provided. Alternatively stud type or insertion type may be considered. Pinch screw type however will not be accepted. All terminals shall be shrouded to prevent accidental contact. Where stud type terminals are offered, it shall be as per clause 3.7.1 (ii).

iii) There shall be at least five terminals spare to terminate spare cores of cable.

3.7.3 Cable Glands

The motor terminal box and actuator terminal box shall be provided with required number of double compression nickel plated brass cable glands to suit cable type and associated size.

3.7.4 Earthing Terminal

Two earthing terminal shall be provided on either side of motor and actuator terminal box.

3.7.5 Painting

The Actuator shall be painted with epoxy-based paint.

4.0 TESTING AND INSPECTION

4.1 The bidder shall adopt suitable quality assurance plan to ensure that the equipments offered will meet the specification requirements in full.

4.2 The bidder shall furnish the Quality Plan in the format enclosed in volume-III. In case the Quality Plan(s) is/are included in volume-IIB, the bidder shall furnish his Quality Plan strictly in line with the same. The Quality Plan shall be discussed and finalised with the technically accepted bidders before opening the price bid. The stages where purchaser would like to be associated for witnessing or verification of tests would be indicated by the purchaser in the Quality Plan before approval.

4.3 The following test shall be conducted as a minimum requirement.

4.3.1 Control Valve

i) Radiographic tests on castings.
ii) Dye penetrant tests on machined surface.
iii) Ultrasonic tests for the forgings & bars of all valves with 60 Kg/cm^2 & higher ratings.
iv) Hydrostatic tests as per ANSI B 16.34 prior to seat leakage tests.
v) Valve closure and seat leakage tests as per ANSI B 16.104 / FCI-70.2.

4.3.2 Pneumatic Actuators

Functional test of actuator and each accessory.

4.3.3 Electric Actuator

i) Routine tests on motors as per IS: 325.
ii) Functional test on actuator and each accessory.
iii) Insulation resistance and high voltage test.
iv) Stall current & Stall torque test.
v) Output shaft speed and torque of actuator and corresponding current tests.

4.3.4 Control valve with Actuator & Accessories fully assembled

i) Functional tests of control valve operation along with actuator & accessories.
i) Dimension checks.

4.3.5 Type tests or Test Reports

i) Valve lift vs. Flow test (Cv Test)
ii) Degree of protection tests for the enclosures
ii) Temperature rise test (applicable for Electrical Actuator only).
iii) Type test for motor as per IS: 325.

4.4 Inspection will be conducted by BHEL and/or their authorised representatives as per the agreed inspection schedule. The inspection schedule will be submitted by the bidder, for BHEL's approval at contract stage. The cost of all tests and inspections will be deemed to have been included in the bid. For all the type tests covered under 4.3.5 above, "Type Test Certificates" as per agreed Quality Plan shall be furnished. In the absence of the same, such Type Tests shall be arranged at the Vendor's works in the presence of BHEL and/or their authorised representatives or in independent Test House/Laboratory approved by BHEL.

4.5 The Standard QP is included in this specification to enable bidder to understand the extent of inspection and testing requirements to execute this job. The successful bidder has to follow the agreed QP, taking care of customer requirements mentioned in Sec-C and submit QP for final approval by BHEL / Customer.

5.0 SPARES AND CONSUMABLES

5.1 Commissioning Spares and consumables

As part of the main equipment supply, the bidder shall supply all commissioning spares and consumables required during Start-up,

5.2 Mandatory Spares

The bidder shall offer along with main offer, the Mandatory Spares as specified in Volume IIB Section-C of the specification. The Mandatory Spares offered shall be of the same make and type as the main equipment.

5.3 Recommended Spares

The bidder shall furnish a list of Recommended Spares along with the normal service expectancy period and frequency of replacement; quantities recommended for 3 years operation along with unit rate against each item to enable BHEL / BHEL's Customer to place a separate order later, if required.

5.4 Special Tools & Tackles

The bidder shall furnish a list of Special Tools & Tackles included in the bid.

6.0 DRAWINGS AND DOCUMENTS

6.1 The bidder shall furnish the following documents in required number of copies along with the bid:

6.1.1 Data sheet-B, completely filled-up along with all enclosures.

6.1.2 Wiring diagrams for Electrical Actuators.

6.1.3 Hook up diagrams of Control Valve with Actuator & accessories.

6.1.4 Valve & actuator assembly dimensional drawings with weights.

6.1.5 Quality Plan

6.1.6 All relevant Catalogs with detailed technical information.

6.1.7 Bar-chart to indicate the time schedule for procurement, manufacture, testing and despatch.

6.2 The successful bidder shall furnish the following documents in required number of copies to BHEL during the contract stage:

6.2.1 For approval

i) Dimensional drawings.

ii) Installation drawings with overall dimensions of the completed equipment and clearances for operation and maintenance.

iii) Data sheet-C, completely filled-up along with all the enclosures including the sizing calculations & noise calculations.

iv) Quality Plan.

v) Test Certificates.

6.2.2 Final / As-built Drawings

Final / As-built drawings / CDs in required number of copies shall be submitted.

6.3 Operation & Maintenance Manuals

O&M Manuals in required number of copies shall be submitted. O &M manuals shall also contain storage and commissioning instructions.

7.0 MARKING AND PACKING

7.1 Marking

A stainless steel metal nameplate should be permanently fixed on each equipment giving its tag number and technical specifications.

7.2 Packing

All equipment / materials shall be suitably packed and protected for the entire period of dispatch, storage and erection against impact, abrasion, corrosion, incidental damage due to vermin, sunlight, high temperature, rain, moisture, humidity, dust, sea water spray (where applicable) as well as rough handling and delays in transit and storage in open.

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8.0 APPLICABLE DATA SHEET FORMS

This document shall be read with one or more of the following data sheet forms :

- Data sheet A&B for Control Valve with Pneumatic Actuator : Data sheet no. PES-145-06-DS1-1
- Data sheet C for Control Valve with Pneumatic Actuator : Data sheet no. PES-145-06-DS2-1
- Data sheet A&B for Control Valve with Electric Actuator : Data sheet no. PES-145-06-DS3-1
- Data sheet C for Control Valve with Electric Actuator : Data sheet no. PES-145-06-DS4-1

SECTION – D

SPECIFICATION FOR MICROPROCESSOR BASED ELECTRONIC POSITIONER (SMART)

(PES – 145 – 06A)

1.0 Electrical :

Input Signal	4-20mA
Power Supply	Loop Powered from the output card of Control System (12-30 V DC)
Hart Protocol	Compatibility for Remote Calibration & Diagnostic (Super-Imposed HART Signal on Input Signal to positioner (4-20mA)
Valve Position Feedback	4-20mA output signal for Position Feedback is to be provided to control system.

2.0 Environment :

Operating Temperature	(-) 30 To 80 Deg.C
Humidity	0-95%
Protection Class	IP-65 (Minimum)

3.0 Diagnostic Features :

Diagnostic / Test Features (to be available in Smart Positioner and shall be accessible through any HMS software)	**Minimum Diagnostic Features Like** • Measurement of Valve positioning timing, • Detection of actuator leakage, • Display of fault alarm. • Logging of alarms and history. • Valve friction/jamming detection. • Detection of valve wear & tear, • Valve stroke length and timing.
	Advanced Diagnostic Features Like (OPTIONAL, if specified in customer's specification) • On line partial closure test. • Valve signature analysis (online graphical/tabular representation of input signal Vs valve travel). • Step response test.

4.0 Software :

Software (to be supplied alongwith smart positioner)	• Windows based software to meet the requirement for configuration, diagnostics, calibration and testing of Valve and actuator. • Easily up-gradable with same hardware and compatible with any Hart Management Systems (HMS). • Shall be capable to cater to all the tags in the specification at the same time.

5.0 Hardware :

Hardware (As required)	1. PC with software for configuring and accessing diagnostic features of the positioners.
	2. Multiplexers for interfacing smart positioner with PC.
	3. Communication cable for interconnecting multiplexers with PC.
	4. RS232/RS485 converter (if required)

Note : Power supply for Multiplexer shall be arranged by the owner.

6.0 Valve Action :

Valve Action	**Direct & Reverse.** (Same positioner for Single Acting or Double Acting And no separate relays required for changing from Single acting to double).
	During Failure of input Electrical signal (4-20 mA), valve to attain fail Freeze position without any external hardware. (Sol valve, Power Supply etc.)

7.0 Flow Characterization :

Flow Characterization	Possible to fit valve characteristic curve linear & Equal percentage

8.0 Performance:

Characteristic Deviation	<=0.75% of span
Ambient temp effect	<=0.01%/Deg C or better.
Dead Band	Adjustable 0.1 to 10%.
Scan Time	10ms
Resolution	<=0.05%
Sensitivity/Linearity	0.3-0.4% of FS
Repeatability	0.32% of FS

9.0 Test Certificates:

Test Certificates/Test Reports for degree of protection, Accuracy and calibration test (as a minimum) to be submitted as per Manufacture Standard / Relevant Standard.

10.0 EMC & CE compliance

International Standard Like EN/IEC. To EN 50081-2 & EN 50082 or equivalent

11.0 Accessories

In Built Operator Panel	Display with push buttons for Configuration and display on the positioner itself
Hand Held Hart Calibrator (Optional)	Universal Hart Calibrator To Be Provided, One Per Unit.
Press Gauge Block	For Supply & Output Pr., Filter Regulator Other Accessories Shall Be Provided As per Control valve hook-up diagram.
Electrical cable entry	½ - NPT, side or bottom entry to avoid water Ingress.

SECTION-D

DATA SHEETS - A&B

Notes:

1. All general technical requirements including material & construction, leakage class, body sizing and Cv sizing etc. shall be as per customer specifications.

2. Type of bonnet shall be according to the service condition. Extension bonnets shall be provided when the maximum temperature of the flowing fluid is greater than 280 ^{o}C.

3. If the downstream is subjected to vacuum, flow direction of the fluid shall be to close. Separate indication for the same has not been made in the data sheet.

4. Valve and actuator shall be designed for full differential pressure (Max. shut-off pressure).

5. Mandatory spares for control valves, shall be as per contractu

BHEL PEM	**DATA SHEET FOR CONTROL VALVES (WITH PNEUMATIC ACTUATOR)**	SPECIFICATION NO.: PE-TS-405-145-I104	
		VOLUME IIB	
		SECTION D	
		REV. NO. 00	DATE : 14.11.2014
		SHEET	OF

Tag No. : FDV-14 Qty.: 1 per Unit Date Sheet No. PES-145-06-DS1-0

DATA SHEET – A & B

	DATA SHEET – A FOR CONTROL VALVE (WITH PNEUMATIC ACTUATOR) (TO BE FILLED BY PURCHASER)		DATA SHEET – B (TO BE FILLED UP BY BIDDER)
GENERAL*	PROJECT	NTPC-3X660MW NORTH KARANPURA STPP (EPC)	.....
	SERVICE	LOW LOAD FEED CONTROL	.....
	LOCATION	[■] INDOOR [] OUTDOOR	.....
	DUTY	[] ON/OFF [■] MODULATING	.....
	PIPE SIZE (inlet / outlet)	ID 220 x 54 | ID 220 x 54	.....
	PIPE MATERIAL (inlet / outlet)	SA 106 GR C | SA 106 GR C	.....|.....
BODY*	MODEL NO.	Bidder to Specify	.....
	TYPE OF BODY: GUIDING : NO. OF PORTS	[■] GLOBE [] ANGLE | [] TOP [■] CAGE | ONE	.....|.....|.....|.....
	BODY SIZE: PORT SIZE: DESIGN CV	Bidder to Specify	.....|.....|.....
	END CONNECTION & RATING (ANSI)	[■] BWE [] SWE [] FLANGED	.....
	BODY MATERIAL	[■] A216 WCC [] A217 WC9 [] SS [] A217 CS	.....
		[] A351 CF8M	.....
	PACKING: MATERIAL SINGLE / DOUBLE	[] PTFE [■] GRAFOIL [] DOUBLE [■] SINGLE	.....|.....
	BONNET TYPE	[] STD [] EXTENDED [] FINNED	.....
	TRIM FORM	[] LINEAR [■] EQ. PERCENTAGE	.....
		[] QUICK OPEN (ON/OFF)	
	TRIM MATERIAL: SEAT | PLUG	17-4 PH SS | 17-4 PH SS	.....|.....
	: CAGE | GUIDE BUSH	17-4 PH SS | 17-4 PH SS	.....|.....
	FLOW	[] BELOW SEAT [] ABOVE SEAT	.....
	OUTLET VELOCITY	[] < 7 M/SEC (WATER) | [] MAC NO. < 1/3(STM)	.....
	REQUIRED LEAKAGE CLASS	[] II [] III [■] IV [] V [] VI	.....
	NOISE LEVEL (dBA) (spec. 3.1.14)	LESS THAN 85 dBA	.....
	VACUUM SERVICE	[] YES [■] NO	.....
	ANTI CAVITATION TRIM	[] YES [■] NO	.....
PNEUMATIC ACTUATOR	MODEL NO. & SIZE	Bidder to Specify	.....|.....
	CLOSE AT : OPEN AT (KG/CM2g)	1.0 | 0.2	.....|.....
	*TRAVEL TIME FOR	<10 sec	.....
	OPEN TO CLOSE, CLOSE TO OPEN	|	.....
	*VALVE POSN. ON SIGNAL AIR FAILURE	[■] TO OPEN [] STAYPUT [] TO CLOSE	.....
	*VALVE POSN. ON SUPPLY AIR FAILURE	[■] STAYPUT	.....
ACCESSORIES	SMART POSITIONER(HART COMPATIBLE)	[■] REQUIRED [] NOT REQUIRED	.....
	AIR FILTER REGULATOR	[■] REQUIRED [] NOT REQUIRED	.....
	AIR LOCK RELAY	[■] REQUIRED [] NOT REQUIRED	.....
	POSITION LIMIT SWITCH	[] REQUIRED [■] NOT REQUIRED	.....
	POSITION TRANSMITTER	Part of Positioner	.....
	SOLENOID VALVE	[] REQUIRED [■] NOT REQUIRED	.....
	E/P CONVERTER	Part of Positioner	.....
	JUNCTION BOX	[■] REQUIRED [] NOT REQUIRED	.....
	HAND WHEEL (SIDE MOUNTED)	[■] REQUIRED	.....
	LOCAL POSITION INDICATOR	[■] REQUIRED	.....

BHEL PEM	**DATA SHEET FOR CONTROL VALVES (WITH PNEUMATIC ACTUATOR)**	SPECIFICATION NO.: PE-TS-405-145-I104	
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DATA SHEET – A & B

DATA SHEET – A FOR CONTROL VALVE (WITH PNEUMATIC ACTUATOR) (TO BE FILLED BY PURCHASER)			DATA SHEET – B (TO BE FILLED UP BY BIDDER)
PERFORMANCE OF VALVE	LINEARITY HYSTERISIS SENSITIVITY ACCURACY (OVERALL)	± 1% ± 1% ± 0.5% ± 2%	…… …… …… ……

	SL. No. +	LOAD	FLOW (T/HR)	INLET PR. KG/CM2(A)	OUTLET PR. KG/CM2(A)	TEMP DEG (C)	CALC ULATED CV	% VLV LIFT	VLV O/L VELOCITY
SERVICE CONDITION*	1.	5% MCR (MIN.SPEED)	111	82	18	111			
	2.	15% MCR	333	122	72	111			
	3.	25% MCR	555	121	116	111 TO 138			
	4.	CHECK-I	901	152	147	159.5			
	5.	CHECK-II	901	152	20	111			
	VALVE TYPE						[] CAVITATION [] FLASHING [■] HIGH DP		
	* MAX SHUT OFF PRESS (KG/CM2g) 505 # * BODY DESIGN : PRESS (KG/CM2g) | TEMP (DEG C) 505 # | 200 * IBR FORM III-C [■] REQUIRED [] NOT REQUIRED						…… ……|…… ……		

TOTAL WEIGHT (VALVE + ACTUATOR + ACCESSORIES) Kg	……

NOTES:

1. * PARAMETERS LIKELY TO CHANGE ON RECEIPT OF PUMP INPUTS FROM BHEL-HYD.
2. + DESIGN CV SHALL BE BASED ON SERVICE CONDITIONS INDICATED AT SL. NO. ___3____ AND SHALL BE CHECKED FOR ALL OTHER CONDITIONS AS PER SPECIFICATION CLAUSE NUMBER 3.1.7.
3. # DESIGN PRESSURE SUBJECT TO CUSTOMER APPROVAL.

SECTION – D

DATA SHEETS – ACCESSORIES FOR CONTROL VALVES

Tag No…… Quantity…… Data Sheet No. PES-145-06-DS1-1

APPLICABLE FOR TAG Nos.WHEREVER STATEMENT "REQUIRED" INDICATED IN THE INDIVIDUAL CV DATA SHEETS

DATA SHEET – A& B for ACCESSORIES

DATA SHEET – A FOR CONTROL VALVE (WITH PNEUMATIC ACTUATOR) (TO BE FILLED BY PURCHASER)			DATA SHEET – B (TO BE FILLED-UP BY BIDDER)
POSITIONER (SMART) WITH HART PROTOCOL	MFR. & MODEL NUMBER	Bidder To Specify	
	BYPASS GAUGE / S ENCL. / CLASS	☐ YES ■ NO / ☐ THREE ■ TWO / ■ IP-65	
	INPUT SIGNAL (Kg / Cm^2)	■ 0.2 – 1.0 ☐ 0.2 – 0.6 ☐ 0.6 – 1.0	
	OUTPUT SIGNAL (Kg / Cm^2) TO	SUIT ACTUATOR	
AIR FILTER REGULATOR TWO (2) Nos. PER CV	MFR. & MODEL NUMBER	Bidder To Specify	
	AIR SUPPLY PRESS (Kg / Cm^2 g)	■ 7.0	
	OUTPUT PRESS (Kg / Cm^2 g)	TO SUIT ACTUATOR	
	FILTER SIZE	5 MICRON	
	OUTPUT GAUGE	■ REQUIRED ☐ NOT REQUIRED	
AIR LOCK	MFR. & MODEL NUMBER	Bidder To Specify	
	SET PRESS (Kg / Cm^2)	Bidder To Specify	
	SUPPLY PRESS (Kg / Cm^2)	■ 7.0	
	RESET TYPE	AUTO	
	VENT PLUG	REQUIRED	
	ENCLOSURE CLASS	■ IP 65	
LIMIT SWITCH	MFR. & MODEL NUMBER	Bidder To Specify	
	OPEN posn / INT posn / CLOSE posn	**1 NO.** / **---** / **1 NO.**	
	CONTACT TYPE	SPDT 2 NO + 2 NC	
	RATING (AC / DC)	5A 240V AC AND 0.2A 220V DC	
	ENCLOSURE CLASS	■ IP 55 ☐	
POSITION TRANSMITTER (PART OF POSITIONER)	MFR. & MODEL NUMBER	**PART OF POSITIONER**	
	TYPE		
	SUPPLY		
	OUTPUT RATING		
	ACCURACY		
	ENCLOSURE CLASS		
SOLENOID VALVE	MFR. & MODEL NUMBER	Bidder To Specify	
	RATING	■ 24V DC ☐ 220V DC ☐ 240V AC ☐	
	TYPE	3-WAY (UNIVERSAL OPERATION TYPE)	
	OPERATION QUANTITY	☐ Stayput ■ Interlock / ■ 1 ☐ 2	
	COIL INSULATION CLASS	CLASS - H	
	ENCLOSURE CLASS	■ IP 65	
HANDWHEEL	ORIENTATION	☐ TOP MOUNTED ■ SIDE MOUNTED	
JUNCTION BOX	NO. OF WAYS	☐ 24-WAYS ☐ AS REQUIRED ■ 36-Ways	
	SIZE AS	REQUIRED	
	CABLE GLANDS (Size / Quantity)	AS REQUIRED (Double Compression Type).	
	ENCLOSURE CLASS	■ IP 65	
I/P CONVERTER (PART OF POSITIONER)	INPUT SIGNAL / POWER SUPPLY	**PART OF POSITIONER**	
	SPLIT RANGE		
	ENCLOSURE CLASS		
	LINEARITY		
	HYSTERIS		
Cu. Tubing & Fittings / per CV	**This is in addition to cu. Tubing and fittings which are integral part of CV**	15 Meters of ¼ " PVC coated Cu. Tubing, with 1 set of Fittings for each CV for connection to IA Header on one end and accessories on another end of CV.	

COMPANY SEAL
NAME
SIGNATURE
DATE

SECTION-D

DATA SHEETS -C

DATA SHEET C

DATA SHEET – C FOR CONTROL VALVE (WITH PNEUMATIC ACTUATOR)
(TO BE FILLED BY THE BIDDER AFTER THE AWARD OF CONTRACT)

GENERAL	PROJECT	
	SERVICE	
	LOCATION	
	DUTY	
	PIPE SIZE (inlet / outlet)	
	PIPE MATERIAL (inlet / outlet)	
BODY	MODEL NUMBER	
	TYPE OF BODY : GUIDING : NO. OF PORTS	
	BODY SIZE : PORT SIZE : DESIGN CV	
	END CONNECTION & RATING (ANSI)	
	BODY MATERIAL	
	PACKING MATERIAL SINGLE / DOUBLE	
	BONNET TYPE / MATERIAL	
	TRIM FORM	
	TRIM MATERIAL : SEAT | PLUG	
	TRIM MATERIAL : CAGE | GUIDE	
	FLOW	
	OUTLET VELOCITY	
	REQUIRED LEAKAGE CLASS	
	NOISE LEVEL (dBA) (Spec. 3.1.14)	
	VACUUM SERVICE	
	ANTI CAVITATION TRIM	
PNEUMATIC ACTUATOR	MODEL NO. & SIZE	
	CLOSE AT : OPEN AT (Kg / Cm^2g)	
	TRAVEL TIME FOR OPEN TO CLOSE, CLOSE TO OPEN	
	VLV POSN. ON SIGNAL ELEC FAILURE	
	VALVE POSN. ON SUPPLY AIR FAILURE	
ACCESSORIES	POSITIONER	
	AIR FILTER REGULATOR	
	AIR LOCK RELAY	
	POSITION LIMIT SWITCH	
	POSITION TRANSMITTER	
	SOLENOID VALVE	
	E / P CONVERTER	
	JUNCTION BOX	
	HAND WHEEL (SIDE MOUNTED)	
	LOCAL POSITION INDICATOR	
	ELECTRO PNEUMATIC POSITIONER	
	PRESSURE GAUGES	

Tag No…….. **Quantity**…….. Data Sheet No. PES-145-06-DS2-0

DATA SHEET C

DATA SHEET – C FOR CONTROL VALVE (WITH PNEUMATIC ACTUATOR)
(TO BE FILLED BY THE BIDDER AFTER THE AWARD OF CONTRACT)

PERFORMANCE OF VALVE	LINEARITY								
	HYTERSIS								
	SENSITIVITY								
	ACCURACY								
SERVICE CONDITION*	**SL.+ NO.**	**LOAD**	**FLOW (T/HR)**	**INLET PR. (KG/CM^2 (A)**	**OUTLET PR. (KG/CM^2 (A)**	**TEMP DEG. C**	**CALCULATED CV**	**% VALVE LIFT**	**VALVE O/L VELOCITY**
	VALVE TYPE								
	* MAX SHUT OFF PRESS (**(KG/CM^{2}g)**								
	* BODY DESIGN : PRESS (**(KG/CM^{2}g)** **| TEMP (DEG. C)**								
	* IBR FORM III-C								
TOTAL WEIGHT (VALVE + ACTUATOR + ACCESSORIES) KG.									

Tag No…… Quantity…… Data Sheet No. PES-145-06-DS2-1

DATA SHEET C

DATA SHEET – C FOR CONTROL VALVE (WITH PNEUMATIC ACTUATOR)
(TO BE FILLED BY THE BIDDER AFTER THE AWARD OF CONTRACT)

POSITIONER (SMART) WITH HART PROTOCOL	MFR. & MODEL NUMBER	
	BYPASS GAUGE S ENCL. CLASS	
	INPUT SIGNAL (Kg / Cm^2)	
	OUTPUT SIGNAL (Kg / Cm^2)	
AIR FILTER REGULATOR TWO (2) Nos. PER CV	MFR. & MODEL NUMBER	
	AIR SUPPLY PRESS (Kg / Cm^2 g)	
	OUTPUT PRESS (Kg / Cm^2 g)	
	OUTPUT GAUGE	
	FILTER SIZE	
AIR LOCK	MFR. & MODEL NUMBER	
	SET PRESS (Kg / Cm^2)	
	SUPPLY PRESS (Kg / Cm^2)	
	RESET TYPE	
	VENT PLUG	
LIMIT SWITCH	MFR. & MODEL NUMBER	
	OPEN posn / INT posn / CLOSE posn	
	CONTACT TYPE	
	RATING (AC / DC)	
	ENCLOSURE CLASS	
POSITION TRANSMITTER (PART OF POSITIONER)	MFR. & MODEL NUMBER	
	TYPE	
	SUPPLY	
	OUTPUT RATING	
	ACCURACY	
	ENCLOSURE CLASS	
SOLENOID VALVE	MFR. & MODEL NUMBER	
	RATING	
	OPERATION QUANTITY	
	COIL INSULATION CLASS	
	ENCLOSURE CLASS	
HANDWHEEL	ORIENTATION	
JUNCTION BOX	NO. OF WAYS	
	SIZE	
	CABLE GLANDS (Size / Quantity)	
	ENCLOSURE CLASS	
I/P CONVERTER (PART OF POSITIONER)	INPUT SIGNAL / POWER SUPPLY	
	SPLIT RANGE	
	ENCLOSURE CLASS	
	LINEARITY	
	HYSTERISIS	
Cu. Tubing & Fittings / per CV	15 Meters of ¼ " PVC coated Cu. Tubing, with 1 set of Fittings for connection to IA Header on one end and accessories on another end of CV	

COMPANY SEAL
NAME
SIGNATURE
DATE

SECTION-D

QUALITY PLAN

	Manufacturer's Name	QUALITY PLAN (Applicable for mentioned three projects)												
BHEL	APPROVED VENDORS AS PER LOA (Refer Note - 1)	ITEM : CONTROL VALVE (Pneumatic)		BHEL QP No. PE-QP-999-145-I 006 A			PROJECT	: 3X660MW NORTH KARANPURA						
		SUB SYSTEM :		REV. No.: 00			PACKAGE							
		Power Cycle and Water System		DATE: 11-11-2009			CONTRACT NO.	: EPC						
				PAGE 1 of 3										

Sl No	Component & Operations	Characteristics	Class	Type of check	Quantum of check M	Quantum of check C,N	Reference Document	Acceptance Norms	Format of record		Agency M	Agency C	Agency N	Remarks
1	2	3	4	5	6		7	8	9	D*	10			11
1	RAW MATERIAL AND BOUGHT OUT ITEMS													
1.1	Body and Bonnet, (Casting/ Forgings), Plug, Stem, Acutator Stem and Seat Rings	a) Physical and Chemical Properties	Maj.	Physical and Chemical Tests	1/ Heat (HT Batch)	1/ Heat (HT Batch)	Tech. Specification/ Approved Drawing	Tech. Specification/ Approved Drawing	TC	√	P	V	V	
		b) Heat Treatment	Maj.	Review of HT chart	Each HT	Each HT	Tech. Specification/ Approved Drawing	Tech. Specification/ Approved Drawing	TC	√	P	V	V	
		c) Internal Quality of casting	Maj.	RT for Body and UT for Bonnet	100%	100%	ANSI B 16.34	ANSI B 16.34	TC	√	P	V	V	Refer NOTE : 2
		d) Surface Quality	Maj.	Visual	100%	100%	MSS SP 55	MSS SP 55	TC	√	P	V	V	
		e) Pressure Test for Shell	Maj.	Hyd. Test	100%	100%	ANSI B 16.34	ANSI B 16.34	TC	√	P	V	V	For Body and Bonnet after machining
1.2	Diaphragm	a) Surface Quality	Maj.	Visual	100%	-	Mfr. Standard	Mfr. Standard	TC		P	V	-	
		b) Hardness	Maj.	Measu.	100%	-	Mfr. Standard	Mfr. Standard	TC		P	V	-	
		c) Endurance/ Life	Maj.	10,000 Cycles	1/ Type	-	10,000 Cycles / As per Mfr. Standard	No Damage	TC		P	V	-	
1.3	Springs	a) Composition	Maj.	Chemical	1 sample/lot	1 sample/lot	Material Spec./ Mfr. Std.	Material Spec./ Mfr. Std.	TC		P	V	-	
		b) Mechanical Properties	Maj.	Mech.	1 sample/lot	1 sample/lot	Material Spec./ Mfr. Std.	Material Spec./ Mfr. Std.	TC		P	V	-	
		c) Dimension	Maj.	Measu.	1 sample/lot	1 sample/lot	Mfr. Std.	Mfr. Std.	TC		P	V	-	
		d) Performance	Maj.	Stiffness Ratio	100%	100%	Approved Drg./ Material Spec.	Approved Drg./ Material Spec.	TC		P	V	-	
		e) Endurance Test	Maj.	Cyclic Test (Endurance)	1/ Type	1/ Type	Approved Drg./ Material Spec.	Approved Drg./ Material Spec.	TC		P	V	-	
1.4	Functional test (Limit switches, Solenoids, Positioner, AFR, ALR, Position Transmitter)	a) Routine Test	Maj.	HV, IR and Continuity	100%	100%	Mfr. Standard	Mfr. Standard	TC		P	V	-	
		b) Type tests	Maj.	Review of TC	1/ Type	1/ Type	Mfr. Standard	Mfr. Standard	TC		P	V	-	
		c) Degree of protection	Maj.	Review of TC	1/ Type	1/ Type	Mfr. Standard	Mfr. Standard	TC		P	V	-	
		d) Functional Test	Maj.	Verifiaiton of Operation	-	-	-	-	-	√	V	V	V	During Final Testing
1.5	Pressure Gauge	a) Performance	Maj.	Review of Calibration TC	100%	100%	Mfr. Standard	Mfr. Standard	TC		P	V	-	
		d) Marking and Dimension	Maj.	Visual	100%	100%	Approved Drg./ Tech. Spec.	Approved Drg./ Tech. Spec.	TC		P	V	-	

LEGEND : RECORDS IDENTIFIED WITH " √ " SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.
M: MANUFACTURER/ SUB SUPPLIER, C: MAIN SUPPLIER, N: NTPC, P: PERFORM , W: WITNESS and V: VERIFICATION AS APPROPRIATE,
HOLD POINTS SHALL IDENTIFY IN COLOUM "N" AS "W", ADS - Approved Data Sheet., TC - Test Certificate, TR - Test Records.

FOR NTPC USE :

CONTRACTOR'S SIGNATURE

REVIEWED BY :

NAME & SIG. OF APPROVING AUTHORITY and SEAL

Dy. General Manager (QA)
एनटीपीसी लिमिटेड / NTPC
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Dy. GM (QA) & I
Engg. Div.

Dy. GM (QA)
Bharat Heavy Electricals Limited
Power Sector - Project Engineering Management
PPEI Building, HRD & ESI Complex
Plot No. 25, Sector - 16A,
NOIDA - 201 301 (U.P.)

	Manufacturer's Name	QUALITY PLAN (Applicable for mentioned three projects)			
भेल/BHEL	APPROVED VENDORS AS PER LOA (Refer Note - 1)	ITEM : CONTROL VALVE (Pneumatic)	BHEL QP No. PE-QP-999-145-I 006 A	PROJECT	3X660MW NORTH KARANPURA
		SUB SYSTEM :	REV. No.: 00	PACKAGE	
		Power Cycle and Water System	DATE: 11-11-2009	CONTRACT NO.	EPC
			PAGE 2 of 3		

Sl No	Component & Operations	Characteristics	Class	Type of check	Quantum of check M	Quantum of check C,N	Reference Document	Acceptance Norms	Format of record	D*	Agency M	Agency C	Agency N	Remarks
1	2	3	4	5	6		7	8	9		10			11
2	INPROCESS INSPECTION													
2.1	Body and Bonnet after machining, Plug with actuator stem	a)Surface Flaws (MPI for Body and Bonnet only)	Maj.	MPI/ PT	All assessible surfaces	All assessible surfaces	ANSI B 16.34	ANSI B 16.34	TR		P	V	V	Butt weld shall be included
		b) Dimensional Check	Maj.	Measu.	100%	–	Mfr. Std	Mfr. Std	Log Sheet		P	-	-	
		c) Hardfacing (Whereever applicable)	Maj.	Hardness Measu.	1 Sample/ Lot	1 Sample/ Lot	Mfr. Std	Mfr. Std	TR		P	V	V	Hardfacing is to be done as per Mfr. Std.
2.2	Guide Bush (Wherever applicable)	a) Dimension	Maj.	Measu.	100%	–	Approved Drg.	Approved Drg.	-do-		P	-	-	
2.3	Lapping	a) Machining surface contact (Blue Matching)	Maj.	Visual	1 Sample/ Lot	–	-	Proper Physical Contact	-do-		P			
3	TESTS ON COMPLETED VALVES													
3	CV TEST (TYPE TEST)	Valve characteristics Pr. Virsus Discharge and Discharge Virsus Opening.	Maj.	Measu.	1/ Type		As per Specifiation and Approved Drawing	As per Specifiation and Approved Drawing	TC	√	P	V	V *	* - NTPC Engg. clearance for CV test shalll be reviewed during final inspection.
3.1	Acttuator Chamber	a) Strength and leakage	Maj.	Pneu. Test	100%	10%	No leakage	No leakage	TR	√	P	W	W	
3.2	Body	a) Leak and Pressure Test	Maj.	Hydro test	100%	10%	ANSI B 16.34	ANSI B 16.34	TR	√	P	W	W	
3.3	Seat leakage test	a) Seat Leakage	Maj.	Hydor/ Pneu. Test	100%	10%	ANSI B 16.104	ANSI B 16.104/ Approved Data Sheet	TR	√	P	W	W	
3.4	Operation tests	a) Valve Traval	Maj.	Measu.	100%	10%	Spec./ ADS / Approved Drawings	Spec./ ADS / Approved Drawings	TR	√	P	W	W	
		b) Opening and Closing Time	Maj.	Measu.	100%	10%	Spec./ ADS / Approved Drawings	Spec./ ADS / Approved Drawings	TR	√	P	W	W	
		c) Linearity / CAM charactristics	Maj.	Measu.	100%	10%	Spec./ ADS / Approved Drawings	Spec./ ADS / Approved Drawings	TR	√	P	W	W	
		d) Hysterisis	Maj.	Measu.	100%	10%	Spec./ ADS / Approved Drawings	Spec./ ADS / Approved Drawings	TR	√	P	W	W	
		d) Operation of limit switch and solenoids and other accessories	Maj.	Measu.	100%	10%	Spec./ ADS / Approved Drawings	Spec./ ADS / Approved Drawings	TR	√	P	W	W	
		d) Predifined valve positon in case of air and signal failure	Maj.	Visual	100%	10%	Spec./ ADS / Approved Drawings	Spec./ ADS / Approved Drawings	TR	√	P	W	W	

LEGEND: RECORDS IDENTIFIED WITH " √ " SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.
M: MANUFACTURER, SUB SUPPLIER, C: MAIN SUPPLIER, N: NTPC, P: PERFORM , W: WITNESS and V: VERIFICATION AS APPROPRIATE,
MAIN SUPPLIER SHALL IDENTIFY IN COLOUM "N" AS "W", ADS - Approved Data Sheet., TC - Test Certificate, TR - Test Records.

CONTRACTOR'S AGENCY

Dilip Mehrotra
Dy. General Manager (QA)
Bharat Heavy Electricals Limited
Power Sector - Project Engineering Management
PPEI Building, HRD & ESI Complex
Plot No. 25, Sector - 16A,
NOIDA - 201 301 (U.P.)

FOR NTPC USE :
REVIEWED BY :

एस. सामंता / S. SAMANTA
उप महाप्रबंधक (QA)
Dy. General Manager (QA)
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A-8A, Sector-24, Noida-201301 (U.P.)

NAME & SIG. OF APPROVING AUTHORITY and SEAL
Engg. Div/QA & I

	Manufacturer's Name	QUALITY PLAN (Applicable for mentioned three projects)												
	APPROVED VENDORS AS PER LOA (Refer Note - 1)	ITEM : CONTROL VALVE (Pneumatic)			BHEL QP No. PE-QP-999-145-I 006 A			PROJECT	3X660MW NORTH KARANPURA					
		SUB SYSTEM :			REV. No.: 00			PACKAGE						
		Power Cycle and Water System			DATE: 11-11-2009			CONTRACT NO.	EPC					
					PAGE 3 of 3									

Sl No	Component & Operations	Characteristics	Class	Type of check	Quantum of check M	Quantum of check C,N	Reference Document	Acceptance Norms	Format of record		Agency M	Agency C	Agency N	Remarks
1	2	3	4	5	6		7	8	9	D*	10			11
3.5	Final Inspection	a) Overall Dimension	Maj.	Measu.	100%	10%	Approved Drawings	Approved Drawings	TR	√	P	W	W	
		b) Cleanliness and Stamping	Maj.	Visual	100%	100%					P	V	-	
		c) Painting	Maj.	Measu.	100%	-	Spec./ ADS	Spec./ ADS	TR		P	-	-	

NOTE : 1 - As on Date agreed sub suppliers are as follows.

1) M/s IL, Palakkad -	**For all pneumatic operated valves up to 2500 Class and up to 500 MW except BFP Recirculation vavle**
2) M/s Fisher Controls, UK/ USA -	**For all pneumatic operated valves of 500 MW**
3) M/s CCI, USA -	**For all pneumatic operated valves of 500 MW**
4) M/s NIPPON FISHER, JAPAN -	**For all pneumatic operated valves of 500 MW except BFP Recirculation valve**
5) M/s EMERSON, FRANCE -	**For all pneumatic operated valves of 500 MW**
6) M/s MIL CONTROLS, ALWAYE -	**For all pneumatic operated valves up to 2500 Class and up to 500 MW except BFP Recirculation vavle**
7) M/s DRESSER MASOLENIEN, FRANCE -	**For all pneumatic operated valves of 500 MW**
8) M/s COPES VULCAN, UK -	**For all pneumatic operated valves of 500 MW except BFP Recirculation valve**
9) M/s FISHER SANMAR, CHENNAI -	**For all pneumatic operated valves up to 2500 Class and for 200 MW and PRDS valves of 500 MW.**

NOTE : 2 - Only for rating class 900 & above and applicable for Body and Bonnet only. Valve stem for dia > 40 MM UT shall be done on 100 % basis as per ASTM A-388 A and ASME B 16.34. For lower rating as per specification. M/s BHEL to mentioned in the endorsement sheet if any changes are made in the NDT requirement as per specification.

NOTE : 3 - A) Air Filter regulator to be procured from M/s Plaka and M/s Shavo norgen. B) Smart Positioner (If applicable) to be procured from Siemens, Yokogawa, ABB, Dressor, Fisher, Smar, Masolenien. C) All other bought out items/ accessories are procured from Valve Manufacturer approved sources.

NOTE : 4 - IBR Cetificate in Form III C shall be submitted if called for in the specification/ Data Sheet.

NOTE : 5 - Copies of all TC for materials duly correlated with Heat numbers, TC for electrical items and mechanical tests (Leak/ Operation) shall be furnished to BHEL for verification and acceptance.

11/11/09 CONTRACTOR'S SIGNATURE.	LEGEND : * RECORDS, IDENTIFIED WITH " √ " SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. M: MANUFACTURER/ SUB SUPPLIER, C: MAIN SUPPLIER,,N: NTPC, P: PERFORM , W: WITNESS and V: VERIFICATION AS APPROPRIATE, "CHP" : NTPC SHALL IDENTIFIY IN COLOUM "N" AS "W", ADS - Approved Data Sheet., TC - Test Certificate, TR - Test Records.	FOR NTPC USE : REVIEWED BY : 11/11/09	NAME & SIG. OF APPROVING AUTHORITY and SEAL Engg. Div/QA & I

DILIP JEJURIKAR
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एस. सामंता / S. SAMANTA
उप महाप्रबन्धक (क्यू ए)
Dy. General Manager (QA)
एनटीपीसी लिमिटेड / NTPC Limited
A-8A, Sector-24, Noida-201301 (U.P.)

SAMPLE COPY for BHEL QP NO - PE-QP-999-145-I006 A
Rev-00 dt. 11/11/09.

TABLE-1

NDT REQUIREMENTS FOR PRESSURE RETAINING COMPONENTS OF VALVES

Valve size NB in mm	ANSI Class upto 300	ANSI Class above 300 upto 600	ANSI Class above 600 below 900	ANSI Class 900 & above & below 4500
Less than 50	Visual	visual	Visual	MPI
50 & above but below 100	Visual	visual	MPI	MPI & RT (on 10% of valves on 100% area)
100 & above but less than 300	Visual	MPI	MPI & RT (on 10% of valves on changes of section & weld ends)	MPI & RT (on 100% area)
300 and above	MPI	MPI	MPI & RT (on change of sections & weld ends)	MPI, RT (on 100% area)

Note:

For body and bonnet forgins UT with MPI may be adopted in place of RT.

For austenitic steel MPI may be replaced by LPI.

1.01.07 **Non Pressure Bearing Attachments**

Load bearing welds shall be subjected to examination by ultrasonic testing (UT) and magnetic particle inspection (MPI) techniques after stress relief (SR). No load bearing welds shall be subjected to MPI after stress relief. The toes of the welds adjoining the drum shall be ground smooth prior to stress relieving before carrying out this examination.

1.01.08 **Steam coil air preheater and fuel oil heater**

Hydraulic pressure test shall be carried out on the heating coils. All pipes, valves steam traps and mountings shall be subjected to hydraulic test as called for under IBR, BS or other approved codes.

1.01.09 **Soot Blowers**

(a) Butt weld between nozzle and lance tube shall be subjected to 100 % radiography tests.

(b) Soot blower shall be subjected to operational checks as below:

(1) Smooth operation

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उप महाप्रबन्धक (क्यू ए)
Dy. General Manager (QA)

DILIP JEJURIKAR
Dy. General Manager (C & I)
Bharat Heavy Electricals Limited
Power Sector - Project Engineering Management
PPEI Building, HRD & ESI Complex
Plot No. 25, Sector - 16A,
NOIDA - 201 301 (U.P.)

SECTION-D

BILL OF QUANTITY

BILL OF QUANTITY

S.NO.	ITEM DESCRIPTION		Qty/Unit	Total Qty.
[A]	**CONTROL VALVES COMPLETE WITH PNEUMATIC ACTUATOR AND ALL ACCESSORIES MOUNTED , PIPED AND TERMINATED ON JB**			
S. No.	**TAG NO.**	**SERVICE**		
1	FDV-14	Low Load Feed Control	1	3
[B]	**1/4" of COPPER TUBING (PVC COATED) (To be supplied Loose)**		25 METERS	75 METERS
[C]	**FITTINGS: (To be supplied Loose)**	**(i)** BRASS FITTING for Connection to Air Filter Regulator	1 Lot	3 Lot
		(ii) BRASS FITTING for Connection to Solenoid Valve	1 Lot	3 Lot
		(iii) BRASS FITTING for Connection to IA Header isolation valve	1 Lot	3 Lot
		(iv) BRASS EQUAL TEE	1 Lot	3 Lot
[D]	CV TEST CHARGES			
[E]	START-UP AND COMMISSIONING SPARES		1 LOT	3 LOTS
[F]	MANDATORY SPARES		1 LOT	3 LOTS
[G]	DIAGNOSTIC SOFTWARE		1	3

SECTION-D

SPARES

[A] LIST OF COMMISSIONING SPARES

S.No.	ITEM DESCRIPTION	QUANTITY REQUIRED
1	Gaskets	One (1) set with each control valve Tag
2	Gland Packings	One (1) set with each control valve Tag

[B] LIST OF MANDATORY SPARES FOR VALVES

S.No.	ITEM DESCRIPTION	QUANTITY
1	Valve trim (including cage, plug, stem, seat rings, guide bushings etc.). Cage is not applicable.	1 set for each type of control valve, whichever is more.
2	Diaphragms, O' rings, seals etc.	100% of all types, make etc.
3	Pressure Gauges of all types, make, rating etc.(if applicable)	10% or 2 nos. of each type whichever is more.
4	Control valve positioners and its accessories	10% or 2 nos. of each type, model and rating, whichever is more.
5	Pneumatic and electro-hydraulic actuator assembly	10% or 2 Nos. of each type, model and rating, whichever is more.

NOTES :
Wherever % is indicated, the quantity shall be calculated for % of supply for total quantity of 3 units of 3x660MW, unless otherwise specified. The quantity to be reckoned for % indicated shall be rounded off to the next higher whole number. For example if the % of total quantity arrived is 0.2, the quantity to be supplied shall be 1 and if the % of total quantity is 5.1, the quantity to be supplied shall be 6.

The exact quantity shall be calculated and finalized during detail engineering after award of contract. Bidder to comply with the quantities without any price/delivery implication to BHEL/End User.
If the Bidder is offering Pneumatic Power Cylinder for the valve then instead of Actuator Diaphragm bidder to offer Pneumatic Power Cylinder with O-rings & Seal Kit as mandatory spare.

SECTION-D

PAINTING

1.06.10 Primer/Painting Schedule

Sl. No	Description	Surface Preparation	Primer Coat			Intermediate Coat			Finish Coats			Total Min. Painting DFT (Microns)	Colour Shade
			Type of Primer	No. of Coats	Min. DFT / coat (Microns)	Type of coating	No. Coats	Min. DFT/ Coat (Microns)	Type of coating	No. Coats	Min. DFT/ Coat (Microns)		
A) Power Cycle Piping													As per NTPC Colour shade/ coding scheme
1.	All insulated Pipings, fittings/ components, Pipe clamps, Vessels/Tanks, Equipments etc.	SP3/SP4	PS9*	1	20	-	-	-	PS9*	1	20	40	
2.	All un-insulated Pipings, fittings/ components, Pipe clamps, Vessels/Tanks, Equipments etc.	SP3/SP4	PS 5	2	25	-	-	-	PS 4	3 **$**	35 **$**	155 **$**	
3	Constant Load Hanger (CLH) and Variable Load Hanger (VLH)	SP4*	PS19	1	35	-	-	-	PS17	1	30	70	
4	Piping hangers/ supports (other than (3) above. (un-insulated)	SP4 (SP6 - for cleaning of weld joints after erection,)	PS 5	1	40	PS 4	1	40	PS 17	1	40	120	
5.	Valves												
	a.) Cast / Forged Design Temo < 60 °C	SP1/SP2 /SP3	PS9	1	20				PS 9	1	20	40	
	Design Temo > 60 °C		#PS9*	1	20	-	-	-	#PS9*	1	20	40	

6.	All auxiliary Structural Steel components for pipe supports	Outside TG building and in SG envelope	SP4*	Inorganic Ethyl Zinc Silicate	1	75	PS18	1	75	a))Epoxy coat b)Final coat of paint PS17	2 1	35 30	250	
		Within TG building	SP4*	-do-	1	35	PS18	1	35	a))Epoxy coat b)Final coat of paint PS17	2 1	25 30	150	
7.	Weld Edges		SP6 (Hand cleaning by wire bursching)	PS13 (Weldable primer)	1	25	-	-	-	-	-	-	-	
B) Steam Generator & Auxiliaries:														
1	All surfaces with temperature 95°C or less and which are insulated		SP3/SP4	PS 5	2	30	-	-	-	PS 4	2 **$**	20 **$**	100 **$**	
2	All surfaces with temperature above 95°C and which are insulated		SP3/SP4	PS9*	1	20	-	-	-	PS9*	1	20	40	
Note: **1)** SG membrane walls and other Flue gas swept pressure part surfaces shall be applied with appropriate primer for protection of surfaces during transit, storage and erection. 2) Painting specification for all other exposed steel surfaces not covered above shall be same as that given in Civil Sub-section, Part-B, Section VI for corrosion protection of steel structures.														
C) LOW PRESSURE PIPING														
1	All Pipes, fittings / components, valves, Equipments etc.		SP3/SP5	PS3/ PS5	2	25	PS 4	1	30	PS 4	2	35	150	As per NTPC Colour

2	Condensate storage tank, (External painting)	SP3/SP5	Epoxy paint minimum DFT 150 micron (finish paint to be preceded by suitable primer paint)	shade/ coding schem e
3	Condensate storage tank (Inside protection)	SP3/SP5	Solvent free epoxy coating (minimum two coats) of total DFT 200 microns.	
4	Drinking water tank (Protection of Internal surface)(if applicable)	Two coats of food grade epoxy paint.		As per NTPC Colour shade/ coding schem e
5	Stainless steel surface, Galvanized steel surface and gun metal surface.	No Painting		
6	On the internal surface for pipes 1000 Nb and above	A coat of primer followed by hot coal-tar enamel or coal tar epoxy painting (cold) shall be applied.		

			Type of Primer	**No. of Coats**	**Min. DFT / coat (Microns)**	**Type of coating**	**No. Coats**	**Min. DFT/ Coat (Microns)**	**Type of coating**	**No. Coats**	**Min. DFT/ Coat (Microns)**	

D) Fire Detection & Protection System, Compressed air system, Hydrogen generation plant and Air-conditioning & Ventilation System

For Fire Detection & Protection System, Surface preparation and painting of Fire Water Storage Tanks, all Steel Surfaces (external) exposed to atmosphere (outdoor & indoor installation), Deluge Valves, Alarm Valves, Foam monitors, Water monitors, Foam Proportioning equipments, Foam makers, etc. should be as per the Part-B, Sub Section-A-16, Fire Detection & Protection System

For Air Conditioning System, Surface preparation and painting of all the steel surfaces (external) exposed to atmosphere (outdoor & indoor installation), centrifugal fans – Casing etc. should be as per the Part-B, Sub Section-A-15, Air Conditioning System.

For Ventilation System, Surface preparation and painting of all the steel surfaces (external) exposed to atmosphere (outdoor & indoor installation), centrifugal fans – Casing etc. should be as per the Part-B, Sub Section-A-23, Ventilation System.

For compressed air system, Surface preparation and painting of all the steel surfaces should be as per the Part-B, Sub Section--A-14 compressed air system.

For hydrogen generation plant, Surface preparation and painting should be as per the Part-B, Sub-Section-A-17 hydrogen generation plant.

D) ESP												
1	All surfaces with surface temperature 95°C or less (with or without insulation)	SP3/SP 4	PS3/ PS3*	1	25	-	-	-	PS 4	1	30	55
2	All surfaces with surface temperature above 95°C (with or without insulation)	SP3/SP 4	PS5	2	30	-	-	-	-	-	-	60

CONTENTS

VOL-III

SCHEDULE OF PRICES

S.NO.	ITEM DESCRIPTION		Qty/Unit	Total Qty.	Price/Unit (Ex. Works)	Price for 3 Units (Ex. Works)
[A]	**CONTROL VALVES COMPLETE WITH PNEUMATIC ACTUATOR AND ALL ACCESSORIES MOUNTED , PIPED AND TERMINATED ON JB**					
1	FDV-14	Low Load Feed Control	1	3		
[B]	**1/4" of COPPER TUBING (PVC COATED) (To be supplied Loose)**		25 METERS	75 METERS		
[C]	**FITTINGS:** **(To be supplied Loose)**	**(i)** BRASS FITTING for Connection to Air Filter Regulator	1 Lot	3 Lot		
		(ii) BRASS FITTING for Connection to Solenoid Valve	1 Lot	3 Lot		
		(iii) BRASS FITTING for Connection to IA Header isolation valve	1 Lot	3 Lot		
		(iv) BRASS EQUAL TEE	1 Lot	3 Lot		
[D]	CV TEST CHARGES					
[E]	START-UP AND COMMISSIONING SPARES		1 LOT	3 LOTS		
[F]	MANDATORY SPARES		1 LOT	3 LOTS		
[G]	DIAGNOSTIC SOFTWARE		1	3		

SCHEDULE OF UNIT PRICES

[B] CONTROL VALVE ACCESSORIES		
S. No.	**ITEMS**	**UNIT PRICE**
1.	POSITIONER (SMART) OF EACH MODEL AND TYPE	
2.	AIR FILTER REGULATORS	
3.	AIR LOCK RELAY	
4.	POSITION LIMIT SWITCH OF EACH MODEL AND TYPE	
5.	ELECTRONIC POSITION TRANSMITTER OF EACH MODEL AND TYPE	
6.	SOLENOID VALVE	
7.	VOLUME BOOSTER (PNEUMATIC RELAY)	
8.	PRESSURE GAUGES OF EACH TYPE	
9.	JUNCTION BOX (36 WAYS)	
10.	HANDWHEE L	
11.	ACTUATOR OF EACH TYPE (Separate list to be attached if required)	
12.	BRASS FITTING FOR CONNECTION TO AIR FILTER REGULATOR	
13.	BRASS FITTING FOR CONNECTION TO AIR LOCK RELAY	
14.	BRASS FITTINGS FOR CONNECTING TO AIR HEADER	
15.	EQUAL COPPER TEE	
16.	COPPER TUBING PER METRE	
17.	VALVE STEM WITH PLUG & SEAT RING EACH SIZE & TYPE	
18.	GASKET OF EACH SIZE AND TYPE	
19.	BODY SEAL GASKETS OF EACH SIZE AND TYPE	
20.	CAGE OF EACH SIZE AND TYPE	
21.	GLAND PACKING EACH SIZE AND TYPE	
22.	VALVE TRIM OF EACH SIZE AND TYPE(CAGE, PLUG, SEAT, STEM)	
23.	DIAPHRAM/ POWER CYLINDER OF EACH SIZE AND TYPE	
24.	VALVE DIAGNOSTIC SOFTWARE FOR SMART POSITIONER(OPTIONAL ITEM)	
25.	HAND HELD HART CALIBRATOR (OPTIONAL ITEM)	

PARTICULARS OF THE BIDDER / AUTHORISED REPRESENTATIVE				
NAME	DESIGNATION	SIGNATURE	DATE	COMPANY SEAL

CV TEST CHARGES

S.NO.	ITEM DESCRIPTION	
[A]	**CONTROL VALVES WITH ALL THE ACCESSORIES**	

S. No.	TAG NO.	SERVICE	CV TEST CHARGES
1	FDV-14	Low Load Feed Control	

INSPECTION SCHEDULE

(PLACE & ADDRESS OF TESTING/ INSPECTION AND ITS SCHEDULE DATE & DURATION IN NUMBER OF DAYS ITEM/COMPONENTWISE TO BE LISTED)

PARTICULARS OF THE BIDDER / AUTHORISED REPRESENTATIVE				
NAME	DESIGNATION	SIGNATURE	DATE	COMPANY SEAL

DEVIATION SCHEDULE

PARTICULARS OF THE BIDDER / AUTHORISED REPRESENTATIVE				
NAME	DESIGNATION	SIGNATURE	DATE	COMPANY SEAL

SCHEDULE OF SUBMISSION OF DRAWINGS / DOCUMENTS, EQUIPMENT MANUFACTURE INSPECTION AND DESPATCH

1.	**ZERO DATE**	**DATE of LOI / FOI / TOI**
2.	Submission of Data Sheets / documents / catalogues / Valve sizing calculations / Noise calculations for approval.	2 Weeks from the Zero date.
3.	Technical finalization, freezing of inputs of manufacture by way of vetting of documents and technical discussions and resubmissions of documents (if required)	6 Weeks from the Zero date.
4.	Inspection of Equipment as per Approved (Category-I) drawings / documents.	24 Weeks from the Zero date.
5.	Release of MDCC by BHEL	26 Weeks from the Zero date.
6.	Dispatch (Packaging & Dispatch)	26 Weeks from the Zero date.
7.	Final documents submission as per Contract	28 Weeks from the Zero date.

NOTE: Delays due to non-fulfillment of the requirements of approved Quality Plan and approved Data sheets; Drawings, Catalogues and Sizing Calculations observed during inspection shall be to the Vendor's account.

Delays due to INCOMPLETE (Partly) submission of Data sheets, Drawings, Catalogues and Sizing Calculations also be considered as **"DOCUMENTS NOT SUBMITTED".**

(Signature and Stamp of the Bidder)